

RUDIMENTARY TREATISE
ON
AGRICULTURAL ENGINEERING;
BY
G. H. ANDREW,
AGRICULTURAL ENGINEER.
VOL. I.
BUILDINGS.

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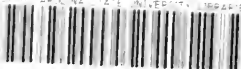
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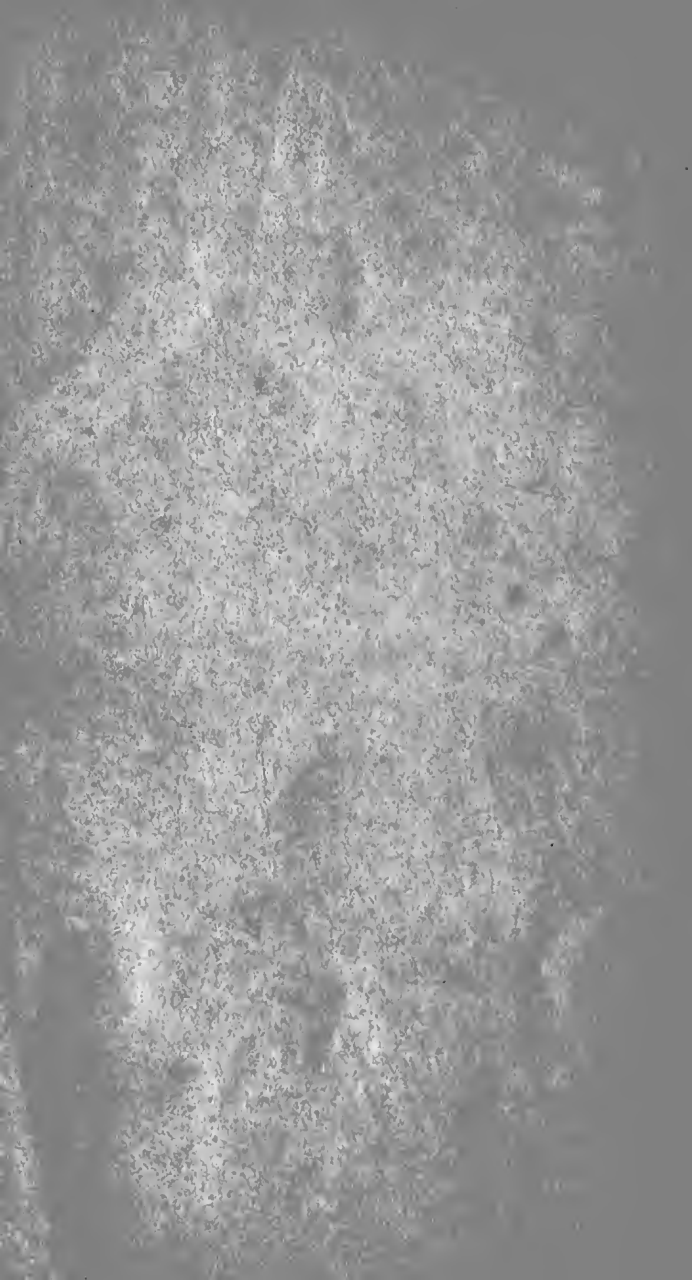
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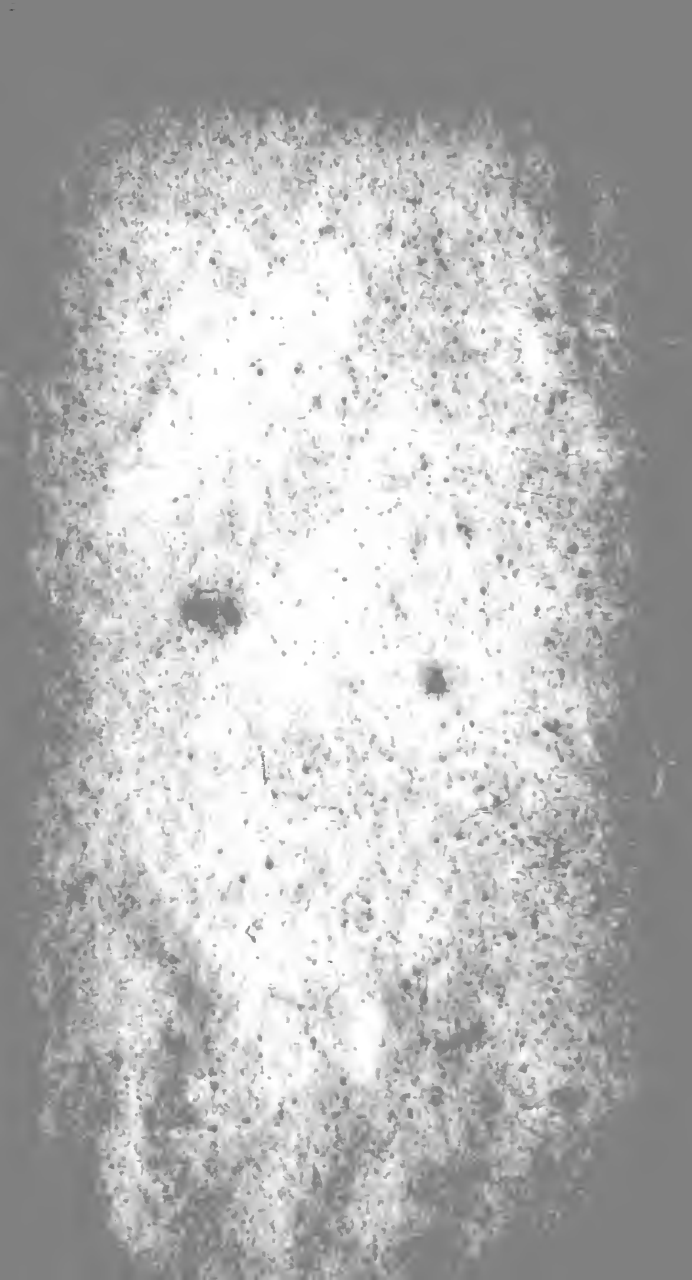
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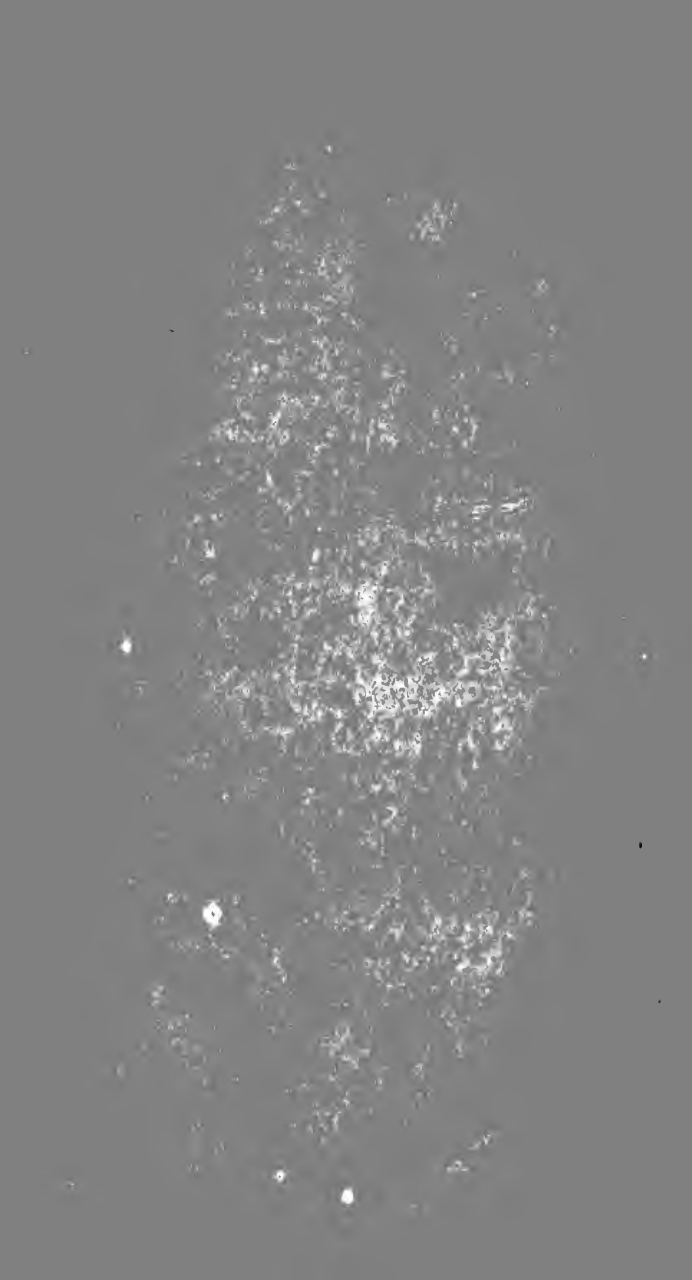
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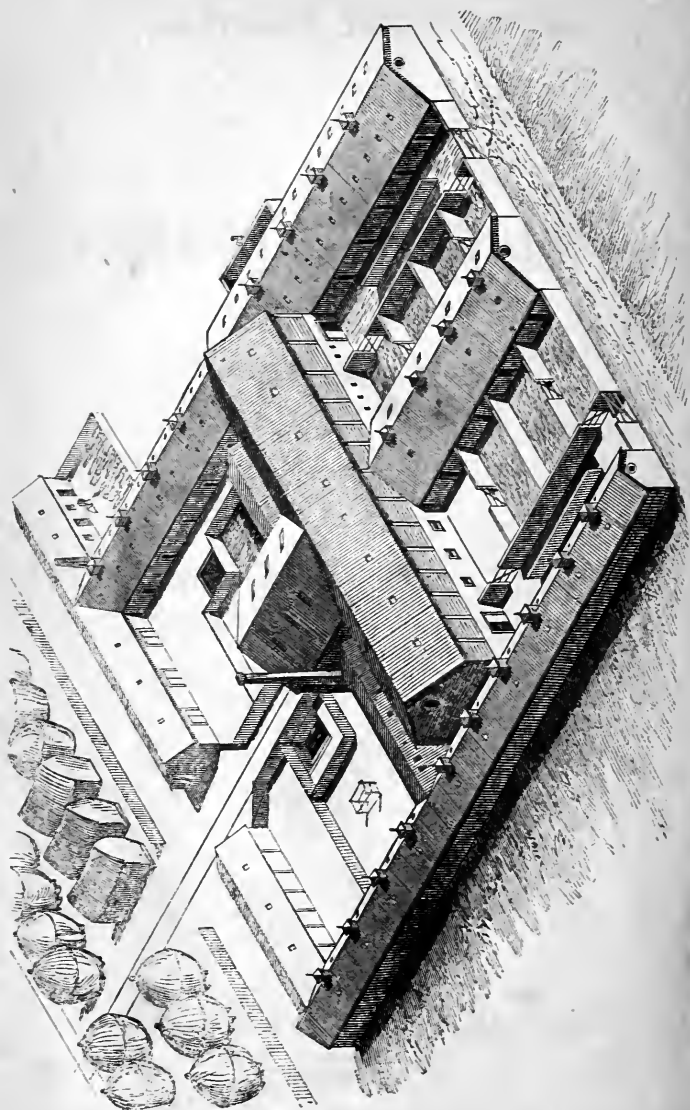
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RUDIMENTARY TREATISE

ON

AGRICULTURAL ENGINEERING;

With Illustrations.

BY

G. H. ANDREWS, C.E.

VOL. I.

BUILDINGS.

London:

JOHN WEALE, 59, HIGH HOLBORN.

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Farm buildings - v. 1
" implements and
machinery v. 2 & v. 3

LONDON:

STEVENS AND CO., PRINTERS, BELL YARD,
TEMPLE-BAR.

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INTRODUCTION.

THE critical position in which the Agriculturists of this country are now placed, with prices so low as to yield them no return for their year of labour, is surely a time when it is especially necessary to give the most attentive consideration to any matter that may tend to preserve to the landlord the present value of his property, and to the tenant farmer his position in life, and the capital he has embarked in agricultural operations. Although the farmers have been in many cases most unjustly condemned by their political opponents for the manner in which they carry on their business, yet there is one point upon which they are particularly open to censure, and that is, the generally miserable state of the premises and buildings that form their steadings.

That they are nearly always antiquated and unfit for the purpose, is a fact that no farmer will deny; and the object the author has in this little book, is to supply him with such necessary data that their reconstruction may be upon the most approved principles. The author having had considerable experience in the erection of agricultural buildings and machinery, and having visited most parts of England, and much of the Continent, with a view to make himself thoroughly acquainted with all that is new and good upon the subject, will endeavour to place before the reader, in the most concise form, the result of his own experience and investigations.

The re-erection of farm buildings is a most important point

to be settled between landlord and tenant. For the latter has a right to demand that he shall be furnished with proper offices suitable for his business, and so arranged that the cost of his labour shall be reduced to the lowest possible point, his stock be preserved in the highest state of health and comfort, and no one particle of his property be wasted or lost, which must be the case if he is without means to preserve the quality and bulk of the whole of his solid and liquid manure.

Until this is done on every farm in England the agriculturists must be considered as in the rear of their rivals, the manufacturers, who economize everything, and leave no stone unturned to discover anything that may facilitate their operations; and scarcely a day passes but something is improved and rendered more perfect. Now this is not the case with the agriculturist; he does know how to improve a thing, and yet does not do it, but leaves it for years in the same inefficient state, and even allows it to wear out, and then reconstructs it in the same manner.

To instance this, are not nine-tenths of the farm steadings in England without gutters to the eaves of their buildings? And does not water from these buildings wash out half the value of the manure? (And I have just seen a set of farm buildings re-erected in Norfolk, where there is a most excellently constructed brick drain made to carry off the liquid manure into the adjoining brook!) Now no farmer could be found who would not condemn this state of things, as being bad; and in no instance is the want of buildings and proper arrangements more conspicuous than in the extraordinary want of care in the preservation of manure always observable in old steadings.

Notwithstanding all farmers know well the value of manure, and that upon the quantity and quality of it depend the amount and value of crop they will get, they never take the smallest precaution to preserve the quality, and seldom the quantity. It is usual to turn the dung out from the

stables and byres into heaps in a yard, which yard always slopes in some direction in which there is a drain, or open outlet, with a constant stream running through,—in wet weather, a full, dark-coloured miniature torrent; and in dry, a sluggish little stream, thick, dark, and brown. This for some reason is generally turned into the horsepond; hence the particularly unwholesome look of the drinking places about old farmeries, appearing as if the farmer was anxious to return a part of his liquid manure into the stomachs of the animals from which it came.

Now, if a farmer, upon receiving the value of his crop at a distant market, found on reaching home that he had been distributing along the way a considerable portion of the coins he had received, through a small hole which he had inadvertently suffered to exist in his pocket, he would be pretty sure, after this discovery, to have this hole immediately mended, to prevent the recurrence of a similar loss. The manure of the farm is the farmer's money; for upon his economy in, and judicious management of this, depend the quantity and value of his crops: and it makes very little difference whether you abstract the means of producing a crop, or the value of a crop when produced.

“For you do take my life,
When you do take the means whereby I live.”—SHAKSPEARE.

That an entirely new, simple, and scientific steadying is necessary to most farms, cannot for a moment be doubted. The last fifty years have so entirely changed the system of agriculture in this country, that the crazy and ill-contrived buildings of existing steadings do not afford nearly sufficient accommodation for the farmer to carry on his operations, with the despatch and severe economy now positively necessary. Apparently, want of room would be the last fault to find with the old steadings, for they appear much larger than the new ones; but this arises from the enormous amount of

barn room formerly thought necessary, for besides these huge barns, and a small, ill-ventilated, dark, and therefore always very dirty stable, with an equally wretched cowshed, there is, in reality, no accommodation whatever. Hence we see the agricultural implements, carts, waggons, &c., lying about unprotected from the weather, in whatever place they were last used. The pigs are in the cow byre, the cows are in the piggery, and the whole place knee-deep in water. It will not be an isolated case when you find a farm in this state—it is the rule rather than the exception. All homesteads of the old school partake of it more or less; and that they should remain so is the more remarkable, from the fact that, in other departments of agricultural science, the greatest improvements have been made of late years; for, in every county in England, we find that most extensive and scientific drainages have been, or are being executed. The unwholesome fens and swamps of Cambridge and Lincolnshire have been rendered salubrious and fertile, and the formerly barren sands of Norfolk now produce the richest crops. The great chalk plain of Wiltshire, the name of which was associated with ideas of naked sterility, is now almost a garden. The very sea has been robbed of its bed, the corn grows where the waves broke; and to assist this work, the manure has been fetched from the antipodes.

I must not be understood to say that there are no scientific and efficient farm steadings in England; on the contrary, examples of such are to be found in almost every county: all I intend to assert is, that they are the exception, and not the rule, while in Scotland the reverse is the case—the good being there the rule, and the bad the exception. Indeed, to deny the existence of good steadings in England, would be doing a great injustice to those enlightened noblemen and gentlemen who have spent so much of their time and money in carrying out the most elaborate systems of farm steadings, and who have called to their aid the most scientific and ex-

perienced men of the day, at an outlay from which they can never expect such returns as those who are wise enough to act upon their results, without having to pay such a price as they did for their acquisition.

It is a curious circumstance that farmers should have availed themselves so little of the examples before their eyes, and, what is still more remarkable, I have generally found them averse to these model steadings. This I know to be the case, as I have at all times and opportunities consulted farmers of intelligence and character for success in agricultural pursuits upon this point, with a view to discover their grounds of objection; and the first of these, as may naturally be expected, is the enormous outlay which has generally taken place in erecting them, and in this they are perfectly right; too much money has invariably been spent, consequent, I think, upon the following causes:—First, that the model stading has generally been built upon very small farms, to which it bore no proportion, for I do not think that a perfect stading, constructed upon the most approved principles, and having all the advantages of fixed machinery and steam power, can be applied (to pay) to a lesser farm than one of 400 or 500 acres under the plough; for it happens that the most costly part of the stading would be equally required on a farm of 200 acres—lengthening the stables and cattle sheds would adapt the same stading for 500 acres, inasmuch as machinery must be of certain dimensions to be effective and economical. As to threshing and store barns, I believe they will be made of one size, both on large and small farms; that is, they will be made to contain about one day's work of the machine, and not, as formerly, to house the whole produce of the farm.

Another reason why the farmer does not appreciate model steadings, is his ignorance of the extraordinary saving effected by having the machinery fixed and of superior construction—at least one-third of the power usually consumed is lost in friction and in the want of proper fitting-up in the working

parts. Although advocating a superior description of agricultural machinery and offices, we must not fall into the error which has generally been committed of drawing an ordinary but very unjust parallel between the farmer, employing machinery for facilitating the operations of agriculture, and the manufacturer, who uses the same for the production of the staple manufactures ; and it is a common thing for those who make the comparison to complain of the farmer's want of appreciation of good machinery and buildings, because he does not choose to go to the same expense in constructing his premises, and procuring the same high finish in his machinery and working gear as the manufacturer does. For this he has a sufficient reason, for it must be borne in mind that a manufacturer, in constructing his premises, calculates that these premises, and the machinery contained in them, will be constantly occupied and in use,—therefore, in the construction of, say his spinning machine, no expense is spared to get the most beautiful and perfect machine, (the spindle, with its warve and flier, is not less carefully made and highly finished for its purpose, than is the escapement of a watch) ; and the manufacturer acts wisely in doing so, for this implement is employed from sunrise to sunset, for days, weeks, months, and years, in pulling down and twisting the miles of tiny thread, every inch of which is producing to the manufacturer a minute profit. But the farmer is totally differently situated with regard to *his* machinery, for he only employs his different machines at particular seasons of the year, and then only for a short time. The machine is then laid aside till the recurrence of the season again brings it into use.

Now it is quite evident that a farmer would not be justified in going to the same expense in the construction and fitting up of his machinery, as the manufacturer does ; the farmer's being only a producing machine for say one-third of the year, and he not being so dependent upon time as the manufacturer, for when his crop is prepared he has no further use for his ma-

chine till next harvest ; whereas every moment of speed gained, and atom of work done additionally, by the manufacturer, is so much increased profit in the year—that portion of his work being finished so much quicker, and the next consequently begun so much sooner. It is in this latter point that he differs so much from the farmer, who, as above stated, however quickly he finishes his portion of work, cannot begin the next similar one until the following year. This is a point that has been very much lost sight of in the construction of what are called model, or example, farms, and hence we see so many attempts injudiciously made to apply the architecture and machinery of the factory to agricultural purposes.

Although it is no part of the object of this book to enter into any discussion respecting the political controversy that now agitates the agricultural world, yet, as the terms high and low farming are constantly occurring, a few words may not be out of place to define the sense in which they are used in this work ; for it unfortunately happens that farmers are apt to associate high farming with the practice of those gentlemen, who, having pockets which overflow with wealth derived from other sources, erect the most costly places imaginable, and carry on their agricultural operations regardless of the great question whether it will pay or not, having only one end in view, which is to carry out their designs in the most perfect manner ; and practical farmers, having their living to get, know well that if they adopted such practices, they would never *get* a living. Hence what is called high farming is, from this cause, looked at by the farmers with considerable caution. Real high farming consists in developing to the utmost the capabilities of the land, by employing on it as much capital as will effect that purpose ; in economizing and preserving every atom of manure ; in reducing all expenses of labour, &c., to a minimum, and in increasing the produce, and consequently the profit, to a maximum. This high farming is that which every farmer will soon have to adopt ; that is, he

must occupy only as much land as he can cultivate thoroughly well, and if his holding be large and his capital small, he must either increase the latter or diminish the former ; for it is quite certain, independent of the question of free trade or protection, that if high farming will not pay, low farming *cannot*.

Supposing a farmer has a quantum of manure, not more than sufficient for one field, it would be a most injudicious proceeding on his part to spread that quantity over two, as he would therefore be paying double the amount of rent, taxes, tithe, &c., of another man who confined his operations to only one field.

Now are not at least two-thirds of the farmers in England following precisely this injudicious line of conduct, by occupying a great deal more land than they make manure for? In other words, farming very low, and losing sight of this important fact, that there are certain constant outgoings common to both a large and small crop grown on the same number of acres. *The farmer therefore who doubles his crops, without increasing his ground, in effect halves those constant expenses, and therefore, by farming high, secures to himself a peculiar source of profit, not available to the low farmer.* Admitting that this principle is true, and that if we are to farm at all we must farm high, both from necessity and principle, we are again brought back to the original subject of farm buildings, which it is the object of this work to describe and discuss.

CHAPTER I.

CHOICE OF SITUATION AND ARRANGEMENT OF THE BUILDINGS THAT FORM THE HOMESTEAD.

CHOICE OF SITUATION FOR ERECTING THE STEADING.

THE choosing of the site upon which to build the steading is a very important matter, and requires much more consideration than would at first appear, for if it has been judiciously chosen a vast annual amount of labour may possibly be saved.

Theory would at once point out the centre of the farm as the spot best suited, but the locality (in nearly all cases) will afford some peculiar advantages that will settle the question; for instance, if water power can possibly be obtained, either from the natural fall of any river, or from the penning up of any little brook, or from the drainage of the land (as has been done in some cases), then it ought to decide the position of the steading at once, as there is scarcely any advantage that can equal a motive power from a natural fall of water, not that an inconvenient spot in other respects should be fixed on, merely because the fall happens to be there, as there are many simple contrivances of engineering for carrying the fall of water to the mill, if it is inconvenient to take the mill to the water.

Facility of access to the turnpike road, or proximity to a railway station, or canal wharf, or the opportunity to discharge the liquid manure from the tanks to some distant spot on the farm by its own gravity, and so avoid the great labour of pumping: all these, and others, are circumstances that will affect the choosing of a site.

But there are certain desiderata that must be sought, and had under all circumstances, such as a tolerably level piece

of ground, or one gently sloping towards the south; this must be perfectly dry, or be artificially made so. Proximity to marshes, ponds of stagnant water, or sluggish rivers, should be avoided; and a plentiful supply of good water must be at hand, and the means exist for procuring an efficient drainage of all the water from above, or from the adjacent land.

If the steading be placed on a bed of gravel, or sand, it will be an advantage.

Having enumerated the chief points to be attended to in the choice of the site, we must next consider the most judicious arrangement of the buildings, yards, &c., that form the homestead of the farm.

The homestead, or onstead, consists of the dwelling-house of the farmer, with the buildings and premises attached, and used by him in carrying on the various operations in his business requiring sheltered or enclosed offices. Scotch writers upon agricultural subjects generally use the word *steading*, in reference to all the offices required for the rearing and fattening of stock, and preparation of crops, and other produce of the farm for market, in which sense it is used throughout this book.

The buildings and offices necessary for a perfect steading on a mixed husbandry farm, will consist of—

Rick Yard.	Engine House.
Straw Yard.	Implement House.
Threshing Barn.	Cart Lodge.
Granary.	Dung House.
Stables.	Manure House.
Fatting Sheds.	Manure Tanks.
Cow Byres.	Wool Room.
Sheep Shed.	Shepherd's Room.
Cattle Courts.	Poultry House and Yard.
Calf Pen.	Infirmary.
Piggery.	Hammels.
Chaff House.	Bulls' Hammels.
Root Stores.	Dairy.
Turnip House.	Cheese Room.
Washing House.	Tool House.
Boiling House.	Farmer's Residence.
Boiler House.	Carpenter's Shop.
Fuel House.	Smithy.

Besides these offices there are other subsidiary buildings required that are not included in the above list, which form what is called the homestead, but will be found treated of under a separate head.

Having chosen the site of the proposed steading, the next step is to construct the most judicious form of ground plan, and this point is deserving of the most serious consideration.

It is a point to which all eminent agriculturists have devoted much of their attention, and the result of their study is, that no fixed form of ground plan will apply equally well to all descriptions of farms, or to all localities; but there are certain fixed principles equally applicable to all, and those principles ought to govern the arrangement of any plan in any locality. It will, therefore, be wise here to consult the opinion of the first authorities who have written upon the subject.

Mr. Stephens (the author of one of the most complete, elaborate, and valuable works in the English language, in "The Book of the Farm," treats of the subject of homesteads at great length, and, with the same care that he has bestowed upon every department of the noble science of agriculture), lays down the following principles, to be kept in view in designing the steading.

"(5.) The leading *principle* on which these arrangements are determined is very simple, and it is this:—

"1. Straw, being the bulkiest article on the farm, and in daily use by every kind of live stock, and having to be carried and distributed in small quantities by bodily labour, though a heavy and unwieldy substance, should be centrally placed, in regard to all the stock, and at a short distance from their respective apartments. The position of its receptacle, the *straw barn*, should thus occupy a central point of the steading; and the several apartments containing the live stock should be placed equidistant from the straw barn, to save labour in carrying of straw to the stock. 2. Again applying the prin-

ciple that so bulky and heavy an article as straw should in all circumstances be moved to short distances, and not at all, if possible, from any other apartment but the straw barn, the *threshing machine*, which deprives the straw of its grain, should be so placed as at once to throw the straw into the straw barn. And, in further application of the same principle, the *stack yard*, containing the unthreshed straw with its corn, should be placed contiguous to the threshing machine. Lastly, the passage of straw from the stack yard to the straw barn, through the threshing machine, being directly progressive, it is not an immaterial consideration in the saving of time to place the stack yard, threshing mill, and straw barn, in a right line.

“(6.) Different classes of stock require different quantities of straw to maintain them in the same degree of cleanliness and condition. *Those classes* which require the *most* should, therefore, be placed *nearest* the *straw barn*. 1. The younger stock requiring most straw, the courts which they occupy should be placed contiguous to the straw barn; and this can be most effectually done by placing the straw barn so as a court may be placed on each side of it. 2. The older or fattening cattle, requiring after the young stock the largest quantity of straw, the hammels which they occupy should be placed next in propinquity to the straw barn. 3. Horses in the stables, and cows in the byres, requiring the smallest quantity of straw, the stables and byres may be placed the farthest in distance from the straw barn. The relative positions of these apartments are thus determined by the comparative use of the straw. 4. There are two apartments of the steading whose positions are necessarily determined by that of the threshing machine—the one is the upper barn or threshing barn, which contains the unthreshed corn from the stack yard ready for threshing by the mill; and the other the corn barn, which is below the mill, and receives the corn immediately after its separation from the

straw by the mill to be cleaned for market. 5. It is a great convenience to have the granaries in direct communication with the corn barn, to save the labour of carrying the clean corn to a distance when laid up for future use. To confine the space occupied by the steading on the ground as much as practicable for utility, and at the same time ensure the good condition of the grain, and especially this latter advantage, the granaries should always be elevated above the ground, and their floors then form convenient roofs for either cattle or cart sheds. 6. The elevation which granaries give to the building, should be taken advantage of to shelter the cattle courts from the north wind in winter; and for the same reason that shelter is cherished for warmth to the cattle, all the cattle courts should always be open to the sun. The courts being thus open to the south, and the granaries forming a screen from the north, it follows that the granaries should stretch east and west on the north side of the courts, and it has been shown that the cattle courts should be placed one on each side of the straw barn; it also follows that the straw barn, to be out of the way of screening the sun from the courts, should stand north and south, or at right angles to the south of the granaries. 7. The fixing of the straw barn to the southward of the granaries, and, of course, to that of the threshing machine, necessarily fixes the position of the stack yard to the north of both. Its northern position is highly favourable to the preservation of the corn in the stacks. 8. The relative positions of these apartments are very differently arranged from this in many existing steadings; but I may safely assert, that the greater the deviation from the principle inculcated in paragraphs (5) and (6) in the construction of steadings, the less desirable they become as habitations for live stock in winter."

I have not been able to discover, on looking over nearly all that has been written upon the subject, anything so clear, or any advice so judicious, as that here given by Mr. Stephens;

in fact, I observe that most of those who have written upon the subject, since the publication of his "Book of the Farm," have adopted his ideas, and often his language, and that, too, without acknowledging from whence they obtained it.

But although I place such great value upon Mr. Stephens's advice up to this point, I do not follow him any further in the carrying out of his details, or the accommodation for each particular head of stock. His plan may be right for the Scotch system of agriculture, but certainly it is not the most judicious for England, especially for the southern counties. The chief objection I have to it is its immense cost; and I am inclined to think that it is only fit for the good old times of high prices, and that we must look in another direction for assistance in the present hour of need (when a quarter of wheat only fetches 36s., and the markets falling), for something cheap; in fact, such a one as a landlord will not mind erecting, and a tenant can afford to pay for: and if cheapness is the object, we cannot do better than look to Mr. John Caird of Baldoon, who gives us a design for a farmery,* embracing all the valuable improvements imported from Auchness, and capable of accommodating 10 horses and 80 head of cattle in stalls, besides implement house, barn, granary, straw and chaff house, clover and turnip house, boiling house, covered dung house, and tank for saving liquid manure, pig and poultry houses, all for 612*l*. This amount of accommodation for such a sum would be, indeed, a saving, as I know of no steading of the same size that has been erected for any-

* The principal difference between the Scotch plan of constructing farm steadings and the English is, that in the former the greater part of the stock are kept in hammels, which are small sheds with yards attached, containing one or several heads of stock; this necessarily causes a much larger quantity of walling, and consequently the cost of the steading is much increased. In England a system of continuous undivided sheds has been adopted instead, and no disadvantage has arisen in consequence that would at all justify the extra expense incurred in the former plan.

thing like the sum; for about 1000*l.* to 1500*l.*, is the usual cost of such sized farmeries when constructed with good materials, workmanship, and in an economical manner—unless some unusually cheap local material is at hand—I am inclined, then, to think that Mr. Caird has under-estimated the cost considerably, or, that he was alluding to particular localities in Ireland; but the latter cannot be the case, as he makes a direct comparison between his own design and that of architects generally, Mr. Stevens and others, and undertakes to save one-third. I have taken the trouble to extract the quantities with considerable care, and moneying them out at the lowest prices I know of work being done for.

The cost of erection stands thus:—

	£	s.	d.
171 cubic yards of excavation to foundations and tank, at 4 <i>d.</i>	2	17	0
46 rods reduced brickwork at 8 <i>l.</i> 10 <i>s.</i>	391	0	0
127½ square Countess slating at 21 <i>s.</i>	133	17	6
510 run of ridge tiles at 2 <i>d.</i>	4	5	0
517 superficial yds. of paving to cattle houses and stable, at 1 <i>s.</i>	25	17	0
1287 cubic feet timber in rafters, joists, &c., sawn, at 1 <i>s.</i> 6 <i>d.</i>	96	10	6
227 cubic feet timber wrought stall posts, &c. at 1 <i>s.</i> 9 <i>d.</i>	19	7	3
Manger complete and fixed at per foot run, 1 <i>s.</i> 6 <i>d.</i>	4	2	6
127½ square slate laths at 7 <i>s.</i> 6 <i>d.</i>	47	16	3
31½ square barn and granary flooring, 1½ thick at 30 <i>s.</i>	47	5	0
4 square 1-inch flooring at 26 <i>s.</i>	5	4	0
551 superficial 1-inch ledged door at 4 <i>d.</i>	9	3	8
750 superficial 1½ wrought boarding between stalls, and to form straw-cutting room at 5 <i>d.</i>	15	12	6
50 run of hay rack at 1 <i>s.</i>	2	10	0
75 superficial yds. of render in cement to inside of tank, at 8 <i>d.</i>	2	10	0
30 superficial yards of tile paving to feeding troughs, at 2 <i>s.</i> 6 <i>d.</i>	3	15	0
21 cwt. 1 qr. 15 lbs. of 5 lb. milled lead in valleys, gutters, &c. at 23 <i>s.</i> 4 <i>d.</i>	24	18	11½
84 superficial of sashes, glazed at 1 <i>s.</i> 6 <i>d.</i>	6	6	0
	<hr/>		
	£841	18	11½
	<hr/>		

Eight hundred and forty-one pounds, then, is the cost

of Mr. Caird's farmery, erected in the most economical manner; but in what state is this steading after this amount has been expended upon it? Why, not in any way complete or fitted for occupancy; for the yards are unpaved and unformed, the clay, or whatever soil the erection might be placed upon, is in the state it was when last used, which might have been as an arable field. There are no gutters to any of the buildings, or rain-water pipes, or water drains to carry it clear of the manure tank. The whole of the exterior wood work is unpainted, and there are no boundary fences or gates to the yards, and scarcely any fixtures of any kind, but the mere shell of a place—undrained, unpainted, and unenclosed. Let us finish it, then, and add to the former outlay of 970*l.* the necessary works required to make it tenable, and which consist of the following, viz. :—

	£	s.	d.
$\frac{1}{2}$ rod superficial reduced brickwork to rain-water tank, at 8 <i>l.</i> 10 <i>s.</i>	4	5	0
15 $\frac{1}{2}$ yards superficial render in cement to ditto . . . at 8 <i>d.</i>	0	10	4
60 feet run inch lead pipe, to supply in bullock sheds . . . at 6 <i>d.</i>	1	10	0
2 $\frac{3}{4}$ draw-off cocks at 2 <i>s.</i>	0	4	0
230 yards run 3-inch eaves guttering at 3 <i>d.</i>	2	17	6
40 yards run 2-inch iron rain-water pipe at 5 <i>d.</i>	0	16	8
No. 12 heads at 1 <i>s.</i> 10 <i>d.</i> , 12 shoes at 1 <i>s.</i>	1	14	0
167 yards run drain from ditto under ground at 1 <i>s.</i>	8	7	0
900 yards superficial paving and forming to yards at 1 <i>s.</i>	45	0	0
76 superficial 3-inch sills to doors at 7 <i>d.</i>	2	4	4
158 yards superficial painting in 3 oils to buildings at 6 <i>d.</i>	3	19	0
77 yards superficial painting in 3 oils to guttering at 6 <i>d.</i>	1	13	6
No. 12 heads at 6 <i>d.</i> , 12 shoes at 6 <i>d.</i>	0	12	0
2 $\frac{3}{4}$ rods superficial reduced brickwork to boundary walls, at 8 <i>l.</i> 10 <i>s.</i>	23	7	6
60 feet superficial 1 $\frac{1}{2}$ -inch gates to yard at 1 <i>s.</i>	3	0	3
2 oak gate-posts at 5 <i>s.</i>	0	10	0
2 pair of hooks and bands to ditto at 2 <i>s.</i>	0	4	0
14 yards superficial painting in 3 oils to ditto at 6 <i>d.</i>	0	7	0
581 yards superficial twice lime-white to walls at 1 <i>d.</i>	2	8	5
	<u>£100</u>	<u>6</u>	<u>3</u>

We have now, then, 100*l.* 6*s.* to add to the former estimate of 841*l.* 18*s.* 1½*d.*, which brings the cost of the steading up to 941*l.* 2*s.* 4½*d.*, which is exceedingly low for the large amount of accommodation ; it is evident, then, that the form of this ground plan is an excellent one, as might be expected from Mr. Caird's practical knowledge of his profession, and his having had the benefit of the assistance of Mr. M'Culloch, of the celebrated farm of Auchness. I considered it of importance to give an engraving of this ground plan, but was not so fortunate as to obtain Mr. Caird's permission. A leading feature in the Auchness farm, and adopted here, is the having a covered dung-house, which Mr. Caird describes as unquestionably the most important part of the whole steading, yet in the judges' report of the Prize Essays of the Royal Agricultural Society, after carefully considering the subject, they arrived at the conclusion that covered dung-houses are not always desirable.

PRIZE ESSAYS AND PLANS OF THE ROYAL AGRICULTURAL SOCIETY.

The Royal Agricultural Society of England, last year, offered a prize for the best essay on agricultural buildings, and it was awarded to Sir J. Tancred, Bart.

The essay, plan, and details, are published in the Society's Journal, with others, by Mr. J. Ewart, Mr. C. Spooner, architect, and John Elliott, farmer ; also by John Hudson, Castle Acre, by Thomas Sturgess, surveyor, of Bedale, Yorkshire, and some valuable remarks by C. D. Tebbutt, engineer : the whole forming the most valuable mass of practical information upon this important subject that has hitherto appeared in print ; and persons about to construct or improve existing farmeries, would do well to consult these valuable data.

The design of Sir J. Tancred is laid out in the form of a square, and consists of three parallel ranges of buildings running north and south, with others transversely on the

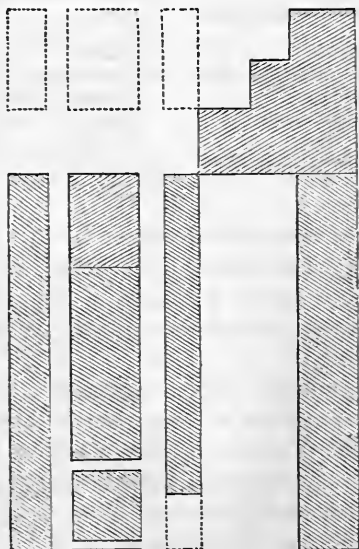
north side, and sheep house, piggeries, and horse boxes detached.

The steading accommodates 50 bullocks, 10 horses, with calf pens, piggery, sheep shed, ample barn room, workshops, a manure depôt (not covered), and every accommodation that can possibly be required for carrying on the business of the farm in the most economical and approved manner.

The total cost of the whole, exclusive of builder's profit, and not including machinery of any kind, is estimated at 1019*l.* 1*s.* 8½*d.*

BLOCK PLAN of a *Design for Steading*, by J. EWART, Esq.

Fig. 1.



Mr. Ewart's design is thus arranged (and is I think one of the best I have ever seen) :—It consists of four parallel lines of cattle boxes, an open yard 30 feet wide, and a line of stabling all parallel to each other, and running north and south.

The boiling house is on the north end, and in the centre of the lines of cattle sheds, and the threshing and straw barns on the north-west extremity of the whole. This plan is capable of very considerable extension, without in any degree impairing the usefulness of any of the original buildings—for the purpose for which they were designed, which is a very important point to be attended to in designing the ground plan of a new homestead. The accommodation consists of

Barn of two stories.

Straw barn or fodder house, with a granary above it on a second story.

Engine room, and shed for engine boiler.

Stabling for 8 horses.

Two loose boxes for stallions, brood mares, or sick horses.

Receptacle for stable dung.

Shed for implements.

Turnip house, fitted with steam apparatus.

Cattle lairs in a double range for 12 fattening beasts.

Cowhouse for 8 cows.

A single range of cattle lairs for 12 beasts.

Ditto for 8 beasts.

Calf house.

Liquid manure tank, to which the moisture of the stables, cow-house, and calf-house may be conducted by covered drains.

Open yard, 30 feet wide, and A watering trough.

The estimated cost of this steading is £1166 16s. 10d. In the same essay are also data of a plan of Lintz Hall farm, near Tanfield, in the county of Durham, and some valuable details of the construction of cattle boxes, &c., well worthy of attention.

The third plan is the joint production of an architect and a practical farmer, Messrs. J. Elliott and W. Spooner, and, as might be expected, a most excellent design is the result of their labours. A large straw and threshing barn is placed at the north side of a square; the sides, and a considerable portion of the centre are occupied by the accommodation

for stock, consisting of loose boxes for bullocks, a lambing house, stables, with implement house, artificial manure house, shed for carts and waggons, and a large covered dung pit, which occupies a portion of the south side of the quadrangle. Down the centre are arranged lines of fattening sheds; between these sheds are two lines of railway, joining at the north end, and being in single line through the centre of the barn, when they again diverge to the east and west through the rick-yard. The plan of this railway is most excellent, as the whole of the manure may be removed direct from the cattle boxes, and, as it is continued up to the dung-pit, by this means it would be a most economical manner of removing so weighty an article as manure. The adaptation of railways in economizing farm labour is a very important point, deserving of great consideration; and a great deal of ingenuity is displayed in this design. Its use is thus described by the author: When the cattle are to be fed, the trucks take up their load of roots, cut or boiled, in the root boiling or cutting store, or the chaff and linseed compound for another meal, obtained each from their respective storehouses adjoining the rail, and proceed on their way through the cattle boxes, giving out to each animal its appointed allowance.

The trucks are again available for littering the animals, procuring the supply from the straw barn; and when the accumulation of manure in the boxes has reached its limited height of increase, the trucks convey the mass of dung direct to the dung pit. One man could then easily, by means of the rail and truck, manage all these operations in a short time, so that the whole of the animals might receive their food with regularity. Even if the railway be not adopted, such an arrangement of building as we have shown would afford great facilities for feeding and littering the stock; the inclined plane from the various store-houses through the cattle boxes may be still retained, and if a plank were laid down, and securely fixed in the centre of the passages between the feeding boxes, a man

would be able to take a good load on a long-frame wheelbarrow; the expense of laying down such planks would not exceed 10*l*.

The accommodation in this steading is for 14 horses, 50 bullocks and cows, with calf pens, sheep shed and piggery, besides corn and straw barns, lambing house, boiling house, &c. &c., and the estimated cost is 1438*l*. 16*s*. 5*d*.

They proposed to construct the whole of the walling with hollow tubes of baked clay. They say that, through the kindness of the Duke of Richmond, the opportunity was recently afforded them of making a practical trial of this method of construction; and, from experience, feel no hesitation in pledging themselves that, with ample strength and equal durability, as compared with common brick walls, their method of construction with these hollow tubes will effect a saving of one-third in the cost per rod in walling.

The next plan is by a practical farmer, Mr. J. Hudson, of Castle Acre, and is on a different principle to those before mentioned, as in this design ample accommodation is provided for stock in enclosed yards, while in the former ones the principle has been to almost entirely dispense with the stack-yard, and place the whole of the stock in boxes or stalls; the two methods have both certain peculiar advantages, which will be more or less adopted as the situation and system of farming require. Mr. Hudson's ground plan is in the form of a parallelogram, lying lengthwise, east and west. On the north side are four yards, 64 feet square, including the sheds, which are 16 feet square, open fronted, and supported by wooden posts set upon stone. On the south side are the cart house, stables, and cart sheds, with granaries over, gig house, fowl house, cooking house, &c.

The buildings to be built with bricks and covered with slates; roofs, &c., Memel timber; oak jambs, posts, &c.; stone bottoms to the story posts of lodges and sheds.

All the yards and buildings to be drained, and the water

carried off by a common sewer* into a reservoir for liquid manure.

The yards to be laid with a fall from each side to the centre to a tank, with grating thereon.

The piggeries to be partitioned into folds, with paved floors; bull and cow houses, and calves' pen, to be paved and fitted up with stalls and feeding manger.

The sheds in cow and cattle yards to be fitted up with feeding cribs. The story posts to stand on brick or stone bases. Cart shed, story posts standing on stone bottoms. Granary to be made over the waggon lodge in roof, 14 feet wide. Cart-horse stable to be made with six loose boxes in each, to be fitted up with iron mangers, rack, and water trough, to be fed at the head. The stores to be kept in corn house, with granary over the same.

The riding stable to be fitted with two stalls and one loose box.

The barn to be built with two floors; the first floor to be of brick, and the second floor to be boarded for threshing and dressing corn, &c.; the threshing to be done by machinery, worked by steam or horse power.

Estimated expense, 1500*l*.

The fifth plan is by Mr. Sturgess, and is arranged in the form of a parallelogram, having the straw barn, threshing barn, &c., placed on the south side; and four lines of buildings, lying north and south, between which are ample fold yards. All the necessary offices are provided and well arranged; there is no striking peculiarity distinguishing this from the others, unless it be, that it partakes somewhat of the plan of Mr. Hudson and the other three combined; that is, the accommodation is divided between fatting boxes or stalls, and folding in yards,—Mr. Hudson having no beasts in boxes, and the former plans being designed specially for feeding in boxes, with little accommoda-

* This must surely be an error in the Journal.

tion for stock in yards. Besides these plans are some remarks on agricultural buildings by Mr. Tebbutt, well worthy of perusal.

The information contained in these essays is decidedly deserving of the most attentive consideration, as it embodies the opinions of some of the most eminent agriculturists of the day, and all the writers are practical men, intimately acquainted with the most approved methods practised in the different counties of England, as well as the particular locality from which they write.

The value of the essays is much enhanced by the fact that the authors practise in the most distant parts of England, as Bedale, Southampton, Mansfield, &c.

It will be observed that all the writers agree in the main principles of laying out the buildings, and that it is much better to fatten stock in warm covered sheds, than in exposed draughty yards. Box feeding seems to be preferred to any other plan of housing stock.

Lord Portman and Mr. Thompson were the judges of the different essays ; and Mr. Thompson, in a letter to Mr. Pusey, prefacing the different plans, has stated what the judges consider to be the main objects to be kept in view in making the decision ; this is well worthy of perusal, as the merits of the plans are discussed in a most impartial manner ; and the following are the conclusions they have arrived at, after a careful investigation of the subject :—

1st. That the communication between the different buildings of a farm should be by means of a paved or macadamized yard, and not across a straw fold.

2nd. That provision should be made for the introduction of loose boxes or stalls for fattening cattle.

3rd. That small open yards with covered sheds should be provided for young or store cattle.

4th. That covered manure pits are not generally advisable.

STEADING FOR A 400-ACRE FARM.

Design for a steading adapted to a farm of 400 acres, 320 being arable, the remainder meadow. The stock is supposed to consist of a breeding flock of ewes, the produce of which are fattened off either as lambs or hogs; both bullocks and pigs are to be bought in.

This plan is the design of Mr. Haslam, a gentleman connected with the celebrated firm of Barrett, Exall, and Andrewes, agricultural engineers and implement manufacturers, of Reading. The leading principle proposed to be carried out in this design, is, that the passage of the straw shall be progressive, from its arrival at the barn till it reaches the manure depôt, never returning, or being unnecessarily carried about, which is too often the case. The stock, while fattening, are proposed to be kept under cover of one large roof, the building being open throughout, and consequently may be thoroughly well ventilated. The stables are conveniently placed in close proximity to the cart lodge, implement house, &c.; it is arranged for 16 horses, and divided in the centre: on each side of this division are funnels or shoots communicating with a loft above. By these funnels the corn and chaff are delivered to the carter, the quantity being regulated by a slide: this plan has the advantage of preventing the accumulation of any stale food remaining, as the last portion is always used first.

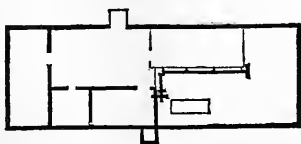
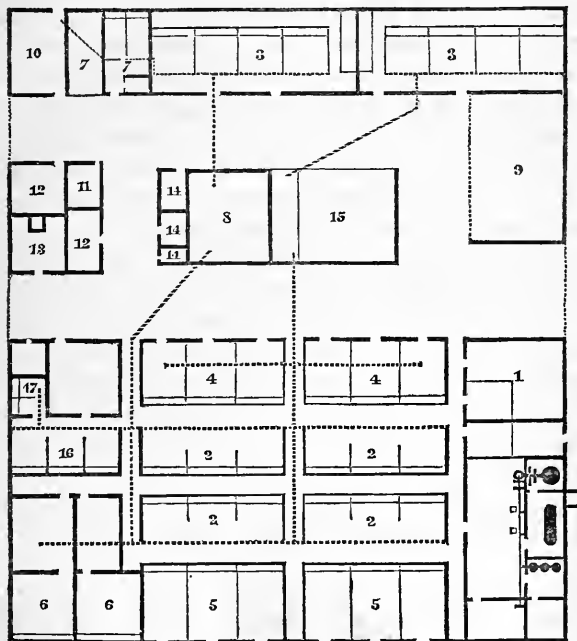
The sheep are housed on sparred floors of the same plan as Mr. Huxtable's. The hogs are similarly accommodated to the sheep, and the division between both hogs and sheep is formed of iron hurdles; this plan being considered the most economical, cleanly, and healthy, by allowing a greater circulation of pure air.

Open sheds, with small yards attached, are provided for young stock and sick cattle.

The corn from the rick is thrown directly into the ma-

chine for threshing and winnowing, and passes it for home consumption directly to the mill, thence to the food house, and from there to the stock; each time it is moved making a step in advance towards its ultimate destination, the manure pit, which is placed under the cart house, and is

PLATE II.



0 5 10 20 30 40 50 60 70 80 90 100 FT

*C

the general receptacle for everything of such nature. The barn part and machinery are well arranged, the author having been assisted in this department by Mr. Bell, the intelligent foreman at Messrs. Barrett's factory. It consists of a six-horse-power steam engine, with machinery for threshing and cleaning the grain, a stone mill, crushing mill, oil-cake breaker, straw and hay chaff cutter, and complete apparatus for steaming the food.* This is in every respect a good plan, and well considered; but I would suggest, that neither cart nor implement sheds be placed over or near manure tanks, pits, or drains, as rapid rotting of wood, and corrosion of iron, must follow such a course.

I object also to the plan of having the stock accommodated in one large building for the reasons mentioned in the description of the West-Peckham-farm steading.

References to Plate.

- | | |
|-----------------------------------|-------------------------------------|
| 1. Barn and Granary. | 10. Cottage. |
| 2. Fattening sheds. | 11. Office. |
| 3. Cart-horse stables. | 12. Carpenter and smith's shop. |
| 4. Hog sties. | 13. Poultry house. |
| 5. Sheep pens. | 14. Ash pit, privy, and tool house. |
| 6. Accommodation for young stock. | 15. Cart shed. |
| 7. Gig house and nag stables. | 16. Cow byre. |
| 8. Manure pit. | 17. Calves pen. |
| 9. Implement shed. | |

LORD TORRINGTON'S MODEL HOMESTEAD.

A few years back a considerable deal of notice was attracted to a farm steading, erected by Lord Torrington at West Peckham, in the county of Kent; and in a book written by his lordship, and published by Ridgway, in the year 1845, is a description of these farm buildings, with some useful general remarks on the agriculture of the county of Kent. Lord Torrington, like most persons who commence the construction of

* The cost of the machinery by this firm, complete to the steading, is about 310*l*.

model homesteads, started with a peculiar notion, upon the correctness of which would depend the success of the steading as an example to be imitated.

This new and leading feature his lordship describes as the "placing the whole farmyard under one roof adjoining the house; the lodges of various descriptions generally required being thereby dispensed with, and the farmer being enabled to see at all times whatever is going on, without the necessity of leaving his room." To effect this object he constructed, in the place of ordinary separate offices, one large shed, 90 feet long in the clear, by 54 feet wide; the height at wall plate 11 feet, and 26 feet to the top of roof; and in this building the cattle are lodged, and a variety of operations are to be carried on. It is calculated to contain 53 head of stock; namely, 32 bullocks, 8 heifers, &c., in addition to whose accommodation there are pens for 9 calves. Now this principle cannot be recommended for general adoption, as on very large farms it could not be carried out, and to construct such immense buildings is extremely injudicious and uneconomical; for as Lord Torrington himself thus observes, when describing this building, "It was a matter of considerable difficulty to know how to cover this *large* roof, *its weight being so great* and its *expanse so considerable*;" and for this reason it was an exceedingly injudicious proceeding to erect it, as it is most important in constructing farm buildings (which for reasons before mentioned, will not pay the interest of money on a large outlay), to have them as small in one dimension as possible; for it should be borne in mind in designing them, that to construct one building twice the width of another will much more than double the cost, as a tie beam for a roof 40 feet span is not only twice the length of one for 20 feet, but it must be much deeper and thicker, and the roof being much heavier, the point of support, the wall, must be much larger.

Otherwise than in the injudicious construction of this large stock lodge, the steading at West Peckham is an exceedingly

good one, and the details are extremely well arranged and designed. Any person interested in agricultural matters will find a considerable amount of valuable information in Lord Torrington's book.

STEADING AT LISCARD, CHESHIRE

(ERECTED BY HAROLD LITTEDALE, ESQ., FROM DESIGNS BY
MR. TORR, OF RIBY, LINCOLNSHIRE).

This is one of the most recently erected farm steadings, it has been visited by most of the leading agriculturists of the present day, and is by all considered to be one of the very best example steadings in the kingdom. The late Sir Robert Peel honoured the property with a visit, and pronounced it to be the most complete he had ever seen.

Mr. Littledale's estate, upon which these buildings are erected, is situated in Liscard and the adjoining township of Wallasey, on the road from Liscard to Poulton cum Seacombe. It consists of an extensive range of farm buildings, including threshing barn, stables, piggeries, fattening and feeding sheds, labourers' cottages, and bailiff's house.

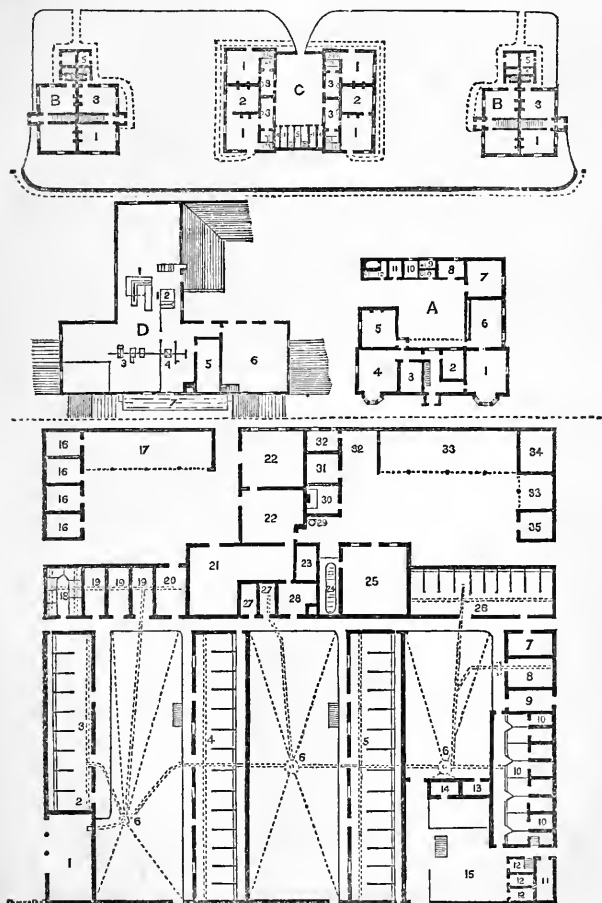
The form of plan adopted is an almost perfect square, surrounded on the north, east, and west with buildings, and on the south having a low wall. This form and arrangement give it an appearance of great compactness.

The square is intersected, east and west, by a range of buildings, consisting of stables, loose boxes, straw and threshing barns, and granaries; and north and south by two ranges of cow byres, and the principal barn. This arrangement of buildings divides it into five courts and yards, as shown in the annexed plate.

Almost in the centre of the steading is placed a substantial range of buildings, two stories in height (the rest are all of one story), which contains, on the ground floor, the straw barns, granary, engine house, boiling houses, cooking house, chaff house, &c.; and on the floor above is placed the threshing

machine and separator, chaff cutters, linseed crushers, and two pair of mill stones, which are placed in the granary on this floor. These machines are all driven by bands from the

PLATE III.*



* Farmer's Magazine, May, 1848.

motive power below. The winnowing machine is on the lower floor. Above the boiling house is a drying kiln, laid with perforated tiles, and heated with steam pipes. Adjoining this building is a raised tank for supplying the premises with water.

On the east side of this building is placed stabling for 10 horses, on the west side loose boxes, &c. The stables are fitted up in the most approved manner; the mangers are of iron, there are no racks, the whole of the fodder being cut into chaff.

Cow Byres.—The accommodation for fattening and breeding of oxen is in three lines of buildings, lying north and south, capable of containing in all 80 head of stock.

They are most excellently arranged in stalls, the divisions of which are formed by placing upright two large slates, secured to each other and to the mangers by iron rods, which keep them perfectly secure in their places.

The piggery is placed on the east side of the range, large and exceedingly comfortable. The feeding troughs are provided with a swinging leaf. Above the piggery is placed the accommodation for poultry.

The cattle courts are roomy and sheltered, and have liquid manure tanks in the centre.

The implement house and cart sheds are placed on the north side, and are spacious and convenient. Adjoining is the drill house, carpenter's shop, and smithy.

On the west side, at the north end, are placed root and potato stores, the floors of which are sunk below the level of the ground. The walls are filled with charcoal to act as a non-conductor.

Besides these offices there are a slaughter house and curing room, a churning house, a compost house, a place for grains, &c.

On the east side of the steading, detached from the principal

range, is placed the bailiff's residence, see Plan, Fig. A; and at the back of this is a range of offices enclosing a court-yard. Here is situated the dairy, which is a most excellent one (and will be found described under the head of Dairies), an apartment for salting and curing meat, and numerous other purposes.

On the south side are placed some well-arranged labourers' cottages.

The motive power is a most excellent steam engine of 10-horse power.

The threshing machine and separator are of the most approved form, and were made and fitted up by Parsons, of Clyburn.

The chaff cutters are by Mr. Corne. The whole of the machinery is of excellent workmanship and well fitted.

Reference to Numbers on Plate 3.

- | | |
|------------------------------|-------------------------------|
| 1. Compost house. | 26. Stable for 10 horses. |
| 2. Bull house. | 27. Cut chaff. |
| 3. Shippon for 16 cows. | 28. Steaming house for roots. |
| 4. Ditto for 28 ditto. | 29. Well. |
| 5. Ditto for 32 ditto. | 30. Smithy. |
| 6. Manure tanks. | 31. Carpenter's shop. |
| 7. Gear house. | 32. Churn house. |
| 8. Milk-horse stable. | 33. Cart shed. |
| 9. Pigs' food. | 34. Drill house. |
| 10. Piggeries. | 35. Slaughter house. |
| 11. Ducks. | 36. Stack yard. |
| 12. Turkeys, geese, &c. | |
| 13. Shed for pigs. | |
| 14. Shed for poultry. | |
| 15. Poultry yard. | |
| 16. Potato stores. | |
| 17. Implement and root shed. | |
| 18. Calf house. | |
| 19. Loose boxes. | |
| 20. Grains. | |
| 21. Straw house. | |
| 22. Barn. | |
| 23. Engine house. | |
| 24. Boiler house. | |
| 25. Granary. | |

Reference A.

1. Parlour.
2. Stores.
3. Office.
4. Living room.
5. Scullery.
6. Dairy.
7. Curing house.
8. Smoking house.
9. Privies.
10. Ashes.
11. Tubs, &c.
12. Oven and Boiler.

Reference B.

1. Living room.
2. Pantry and stairs.
3. Kitchen.
4. Ashes.
5. Coals.

4. Coals.
5. Ashes.

*Upper Floor of Barn D.**Reference C.*

1. Kitchen.
2. Parlour.
3. Scullery.

1. Threshing machine.
2. Separator.
3. Hay cutters.
4. Linseed crusher.
5. Drying kiln.
6. Granary.
7. Tank.

MR. TIMM'S FARM, NEAR FRIMLEY, SURREY.

Amongst the many farms claiming to be considered as a model or example at the present time, I know of none to which more properly belongs the application of that term than does the little farm near Farnborough, belonging to Mr. Timm, for he sets the best of examples to his neighbours (and no one's neighbours need it more than his). I believe the native agriculturists of the district are much indebted to him for the introduction to their notice of many improved implements, as well as systems of husbandry ; nor is it possible for the farmers of this district to be continually passing his well-ordered farm, with its small trim fences, clean land, and the grand ultimatum, heavy crops, without being struck with the fact that they have something to learn, and might, if they tried, do a great deal better than they do, if not quite so well as he does.

Mr. Timm's farm is situated about a mile from the Farnborough station on the South Western Railway, in the middle of the district geologically known as the Bagshot sand, perhaps the poorest description of soil in the kingdom, being purely a silicious sand, and not containing a single element besides, with which to supply nutriment to the plants growing upon it ; the consequence is, that nine-tenths of the whole district is a barren heath, not affording a bite for the nearly starved animals that are occasionally to be met with upon it.

The lands of this district vary in quality more or less as they

approach and are mixed with the London clay, the underlying stratum upon which the formation rests ; when much clay is mixed with sand, as it is about Hartford Bridge, the land is an easily worked, excellent loam, and lets for a high price.

Mr. Timm's farm is situated upon a middle description of the Bagshot sand, not nearly so good as the best, nor quite so bad as the worst, but a soil that would be, if in a state of nature, of a yellow, slightly loamy sand. Very much of this description of soil is out of cultivation, and that which is cultivated, with this exception, produces only the poorest crops.

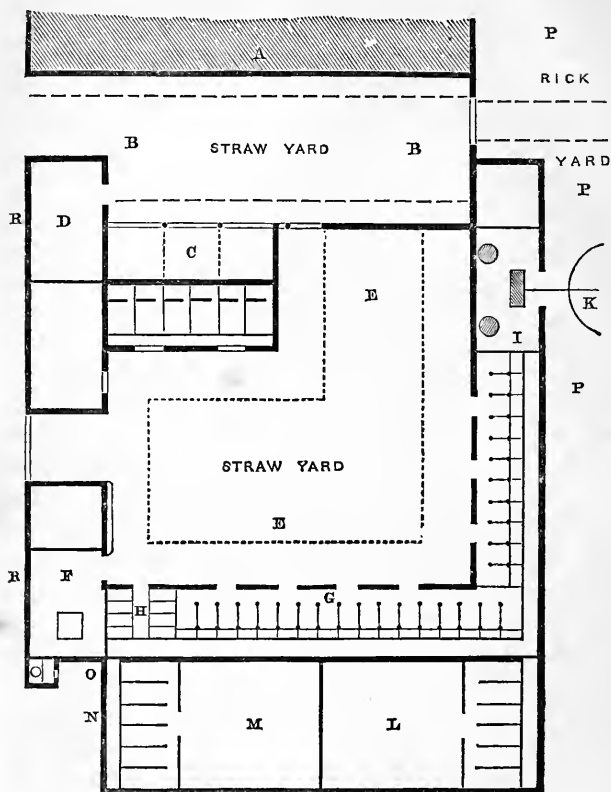
Mr. Timm, then, is entitled to no small credit for growing regularly on such land a load of wheat to the acre, and that wheat 65 lbs. to the bushel, and all other crops similar in quality and quantity. There is no ostentatious display here, as in some model farms I could mention ; everything is conducted on the most orderly and apparently ordinary manner, nothing is stinted and nothing wasted, and if farming can be made to pay at all, it will do so here.

How is it now that this poor land is made to yield double, and in some cases treble, the amount of produce of those in the neighbourhood ? Simply by farming higher (that is better), and employing as much capital as is necessary, and by keeping on this small farm (I think about 250 acres) 60 head of oxen, 350 sheep, 70 hogs, and 20 horses (12 of these at work).

The whole of the animals used upon this farm are of the choicest breeds, and are fatted to very heavy weights.

The consequence of this is, that an unusually large bulk of manure is annually made and applied to the land in the most judicious manner, that being the only way that such results are to be obtained.

The farm buildings, which is the point more immediately under our attention, have been constructed with great judgment, having a strict regard to economy.

PLATE IV.—*Ground Plan of the Steading.*

A is the threshing barn, with straw and hay barn and granary adjoining.

B a straw yard.

C open stalls for stock.

D cart house and nag stables.

E straw yard, with paved causeway round it.

F the food cooking house, with steam boiler and steaming apparatus.

G a range of buildings divided into stalls for bullocks, with a gangway at the head for feeding the animals.

H calf pen.

I a building containing the chaff machine, bean mill, oat crusher, &c., worked from the horse gear at K.

L hammels and small yard for sick and other stock.

M hammels for two bulls.

N liquid-manure tank and pump.

O labourers' closet.

P stack yard.

R road.

The yards have a raised causeway round them to facilitate the business of the steading, and slope towards the centre, where drains are placed to carry the liquid manure to the tank; the buildings are all guttered, and every means taken to preserve the liquid manure from waste or dilution.

I think this ground plan, with some modifications, is well adapted to moderate-sized farms. The cattle sheds were constructed (with a view to economize materials) exceedingly low, and the result is, that in summer they are inconveniently hot. This may be easily obviated by covering the rafters with thin boards (5-cut stuff), and upon them placing a layer of felt and the slates upon it. The felt is very cheap (1*d.* per foot), and will have the effect of keeping out the cold of winter as well as the heat of summer. I have lately tried the plan by constructing the roof of a dwelling-house in this manner, and found great benefit in consequence. Mr. Timm's farm is the only one I know of where an attempt has been made to farm high upon the Bagshot sand; he has been singularly successful, and the agriculture of the district will, I am sure, be eventually raised higher from his example.

A most laudable attempt is being made in the same direction by another gentleman in this locality, upon some of the most worthless land in Great Britain, being the worst of the Bagshot sand before mentioned, but the liberal and vigorous system he is pursuing is likely to bring even it into heavy and good crops.

I must not conclude an account of Mr. Timm's farm with-

out remarking that he is fortunate in having for his bailiff so enthusiastic and intelligent a man in his art as Mr. Huty.

A SCOTCH STEADING.

Plate V. is the ground plan of an extensive Scotch steading,* considered by Mr. Stephen as a good example of its kind.

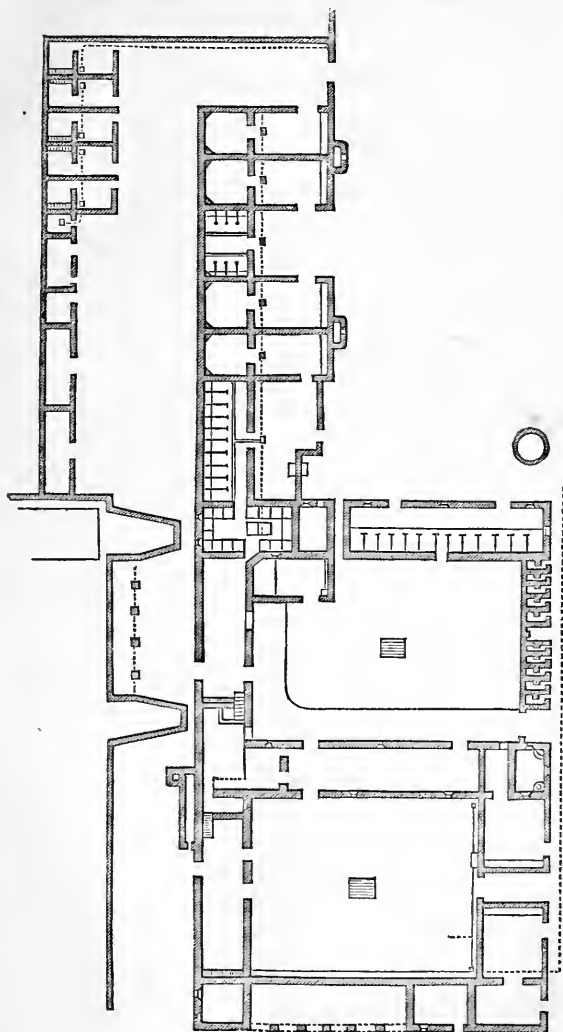
The agricultural character of Scotland stands much higher than that of England, for the Scotch have doubtless displayed more energy and ability in the management of their land than their southern neighbours; nearly all great improvements in agricultural machinery have originated with them. The threshing machine was invented, ploughs immensely improved, and the steam-engine first generally introduced for agricultural purposes, north of the Tweed. It was not likely then that while other departments were advancing they would leave their homesteads unimproved; and consequently we see an extensive orderly well-regulated steading, with steam-engine attached, on every farm in the highly cultivated districts.

It is from the Scotch models that the English improved steadings have chiefly been copied, but the more recently erected are improvements upon them.

The principal difference between the Scotch plan of constructing farm steadings and the English is, that in the former the greater part of the stock are kept in hammels, which are small sheds with yards attached, containing one or several heads of stock; this necessarily causes a much larger quantity of walling, and consequently the cost of the steading is much increased. In England a system of continuous undivided sheds has been adopted instead, and no disadvantage has arisen in consequence that would at all justify the extra expense incurred in the former plan.

* See, for further elucidation, Mr. Stephen's valuable work, entitled the "Book of the Farm."

PLATE V.



DESIGN FOR A LARGE STEADING.

PLATE I.—Isometrical view.

PLATE VI.—General plan.

PLATE VII.—Enlarged plan of threshing barn, engine house, cooking house, &c.

PLATE VIII.—Transverse section of threshing barn, straw barn, granary, &c.

This is a design for a homestead of the largest class, where all the operations are carried on in the most systematic manner, and is arranged according to the principles previously laid down.

The whole of the stock fattening for the butcher receive their food in stalls or boxes, while the young stock are accommodated in yards and hammels.

The whole of the stock receive food previously prepared, by cooking or otherwise; it is conveyed to them by means of a railway. This is rendered practicable by means of three turntables.*

The trucks running on this railway are arranged to take the food direct from the coppers, the roots from the stores, the chaff from the machine, and the meal from the granary or meal room, without any extra carriage; it being evident that, by adopting this plan, a great amount of manual labour may be saved, as well as loss or waste, from the food being dropped about in passing from one place to another. The food is all supplied at the animals' head, in a convenient manner, from the rail passage, which also offers great facility for the proprietor inspecting every head of stock by a few minutes' walk, without dirt, inconvenience, or danger. This facility for getting at the animals will be found of great advantage at night by the stock feeder, and prevent accidents.

* These are so constructed as not to cost more than 4*l.* 10*s.* each (see Second Part, on Agricultural Railways).

The straw barn is placed to receive the straw direct from the threshing machine; it may be made so large as to occupy the entire space shown in the plan (or even more), or it may be reduced to any dimensions, however small, without interfering with the advantages it possesses from its situation; that is, the being placed in the centre of all the stock, thereby offering the greatest facility for supplying all the boxes, stalls, hammels, yards, &c., with this bulky article.

The horses are placed in a position inaccessible to all other stock, in close proximity to the supply of chaff, corn, and straw.

The implement house, smithy, and shoeing place, are together, and also join the stable.

Everything belonging to it lies by itself, requiring neither the labourers connected with it to visit other parts of the farmery, or those connected with other departments to visit it; thereby preventing all idle gossiping and waste of time amongst the persons employed, or the interference of any one person's duty with that of another.

The granary is placed above the threshing barn and part of the straw barn. It is intended to receive the whole of the corn immediately after threshing, so that there be neither waste nor robbery.

The building containing the granary is proposed to be constructed in a much more substantial manner than any of the other offices; and for this purpose, it is so arranged that all the most valuable portion of the property of the tenant shall be contained in it. (By the adoption of this plan the cost of the other buildings may be lowered.)

The lower floor contains the winnowing and other apparatus for cleaning the corn, and tackle for raising the various articles to the mills above.

The floor of this building is proposed to be sunk three feet below the level of the ground outside, to enable the rick-yard

waggon to deliver the sheaves on a level with the threshing barn, and render the use of elevators unnecessary.

The middle or stage floor is constructed in a substantial manner, strongly framed with timber, and upon it are placed the threshing machine and straw shaker, the barley hummeller, the smut machine, the bruising mill, oil-cake crusher, steel mill, and a pair of meal stones, dressing machine, &c. The threshing machine occupies the centre of the stage, and the smaller machines are placed against the walls, so as to be out of the way of the operation of thrashing.

On the upper floor of this building is the granary, fitted with hoppers to supply the corn to the machines below. A sack tackle is constructed in the roof of this apartment, and there are sack traps to each floor for the convenience of hoisting the sacks.

By the side of this building is placed the steam engine.

The boiling house adjoining is a small detached building.

The fuel house nearly adjoins the boiler house.

The cooking house is next the engine-boiler house, from whence the steam is supplied for cooking the various roots, steaming chaff, &c.

The meal store, cooking house, chaff house, root-washing house, and root stores, are close together, and from them the railway communication is perfect to *every animal in the building*; the chaff and corn are delivered at one end of the stable into a small apartment partitioned off for the purpose.

The meal house is so situated as to be supplied by shoots direct from the granary.

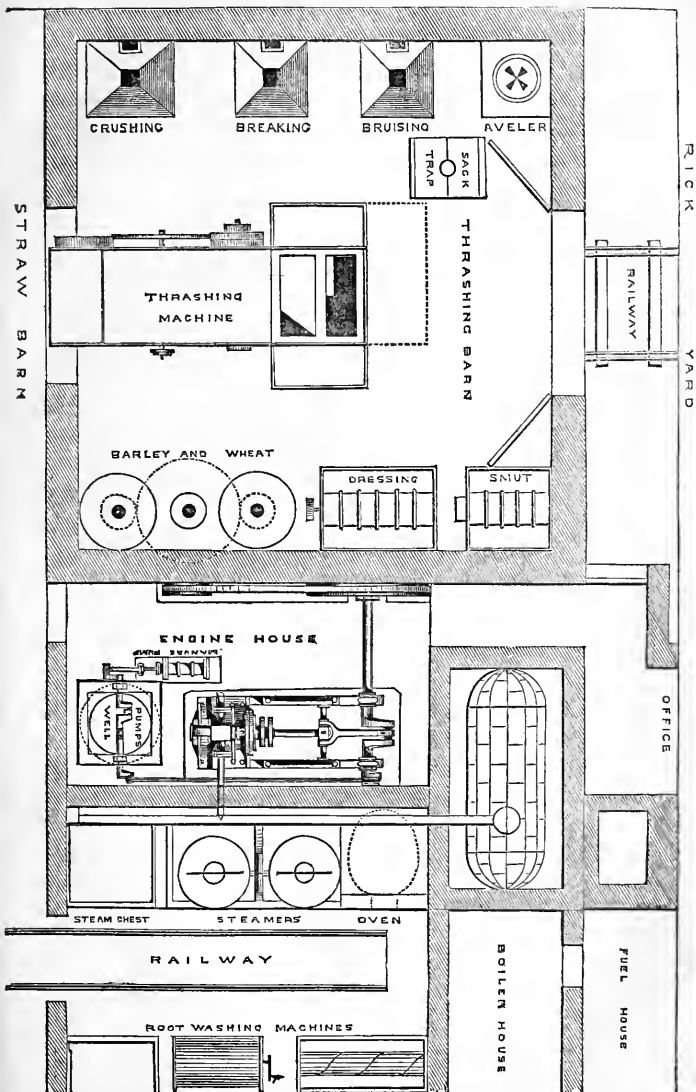
The straw is brought from the ricks to the threshing barn by a peculiar truck* which I have invented for the purpose, and is designed to run on lines of rails at right angles to each other; this is to obviate the necessity of using turntables,

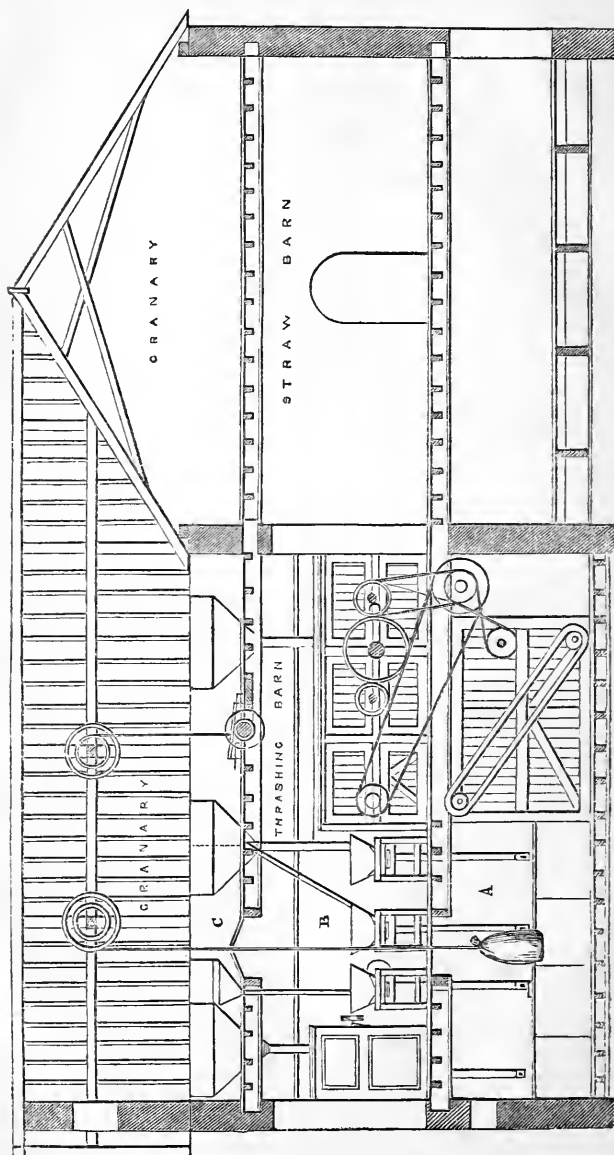
* For description and plan of this truck, see Part II.

several of which would be necessary, as the lines of ricks are arranged at right angles to each other, so that any particular rick may be got at that may be required to be immediately used.

The manure is cast out from the various courts, boxes, stables, &c., into pits conveniently placed for the purpose, from whence it is carted to the middens, or to the land; from beneath these pits are pipes to carry the liquid manure to a common receptacle, from whence it is pumped by the engine into a tank placed at a high level on the farm, or into an elevated iron tank, so that it may descend by its own gravity to the land when required. I consider that a great saving will arise by thus throwing upon the engine the whole labour of pumping up the liquid manure, in lieu of its being pumped from the tank by the carters, and carried to high levels in carts drawn by horses. Should this plan not be adopted, that is to say, of placing the tank at some distant spot, I would recommend that it be raised sufficiently high to fill the carts, (instead of being a sunk well,) and be filled by the engine instead of hand labour.

PLATE VII.—*Enlarged Plan of Threshing Barn.*





CHAPTER II.

ACCOMMODATION FOR STOCK.

THE breeding, rearing, and fattening of stock are a most important division of the business of a farmer, demanding his utmost care, skill, and attention. Badly bred, fed, or housed stock are not consistent with good farming, and can never be made to pay. It has been before observed, that high farming is economy of labour and manure, and plenty of both. Now the economy of labour and manure, in reference to stock, will depend principally upon the judicious arrangement of the sheds, hammels, courts, &c., for the better supply of food, removal of the dung, and preservation of the liquid manure.

In the old steadings no arrangements exist for securing any of these advantages, and the accommodation is of the poorest description,—small, ill-contrived, and quite unfit for the most approved present systems of managing stock.

The size and arrangements of buildings for stock will, of course, depend a great deal upon the description of steadings, whether for dairy, stock, or sheep farm; but this little book being only an elementary treatise, we shall confine ourselves more particularly to mixed husbandry, of which description by far the larger number of English holdings are.

The buildings and other accommodation necessary for the mixed-husbandry farm, to accommodate the stock, consist of

Stables for working horses.
Fattening sheds for bullocks.
Byres for cows.
Sheds and pens for calves.
Piggeries.
Sheep sheds.

Hammels for young stock and
bulls.
Infirmary for sick cattle.
Yards for folding stock at night
and in inclement weather.
Small buildings for poultry, &c.

STABLES.

The Cart-Horse Stable.—I have heard it asserted by good authorities in agricultural matters, that they could tell the state of everything else on the farm, if allowed to inspect the cart-horse stables; and I have no doubt of the fact, for I know of nothing so indicative of good farming as a well-ordered stable.

The accommodation for working horses is in most old steadings of the most wretched description—low, dark, filthily dirty, and very unwholesome (from want of proper ventilation), and in consequence, farmers' horses are generally found in an unhealthy state (though want of food has something to do with this—bad farmers being proverbially bad masters to their horses).

In constructing farm-horse stables, it is of the first importance to give them room enough (12 ft. in height and 16 in width are the minimum dimensions).

This 16 ft. width should be appropriated in the following manner:—2 ft. for the manger, 7 ft. for length of stall, 1 ft. for the drain, 4 ft. for a clear gangway behind the horses, to facilitate the removal of manure, and the other business of the stable, and 2 ft. for the projection of the harness, &c., hanging on the tacks behind each horse.

Separate stalls should be provided for each animal by a partition called a travis. (On no account should a swinging bar be used, bad accidents often occurring from this ill-advised economy.) The travis should be five feet high at the tail post, and rise to seven feet at the head, as shown in Plate IX.

The posts for supporting it should be of oak or cast-iron, securely fixed into the ground, and, if the construction of the stable admits of it, also to the joists of the floor overhead.

The top of the travis, called the ramp rail, should also be made of oak, tenoned into the tail post at one end, and the

bond timber of the wall at the other. On the under side is a groove in which the upper end of the stall boarding is placed, the lower ends being secured in the same manner, with a corresponding piece of timber, or, what is better, stone, which is grooved in the same manner as the ramp rail.

The divisions of stalls are made in a variety of ways, according to the description and cost of the stables. The directions here given apply to farm-work-horse stables, where no unnecessary outlay is expected to take place.

The rack and manger are variously placed; the usual plan is a wooden or stone trough, extending the whole length of the stable, and the rack in the same manner above—the hay being dropped from the loft overhead into it; but this plan is liable to a variety of objections. The rack being placed overhead, the horse will draw and let fall among the litter (and therefore waste) as much as he eats. Blindness in horses also is frequently caused by hay-seeds falling into their eyes when eating from high racks; nor can the defence of its producing high carriage apply in the case of work horses, as they are not required to hold up their heads, like carriage and other horses; and generally, on returning to the stable, are so tired, that it is unnecessary cruelty to force them to feed in that way. The most approved plan is to place the rack low down in one angle, and the manger in the other, which allows of the horse eating while lying down. The manger is often made the whole width of the stall, sloping inwards towards the ground, to be out of the way of the horse's fore-legs.

In the woodcuts I have not shown any rack, nor should ever think of using one myself; but I know some horse-keepers are made quite unhappy by the sight of a stable without racks, as I have frequently found them putting a pile of hay upon the litter in one corner of a stable, although the horses never eat a mouthful of it. The plan now generally adopted, and found to answer, is to give the horse nothing but

chaff, and very often the oats bruised and mixed with it. I have myself tested the merits of this plan, and shall always in future adopt it. When food thus prepared is placed in the long manger, it is necessary to put small bars across, in two or three places, to prevent the horse routing the food over the edge with his nose.

The floor of the stable is paved in various ways, changing with the materials found in different localities. For a description of these see article on Floors for Agricultural Buildings.

Drainage.—The paving of the stalls should slope from each side slightly towards the centre, and from the head to the hind post, not more than about one inch in four feet. If more than this the horse will not stand comfortably, as there will be a continued strain on the tendons of the hind legs. It has been observed, that a horse will always choose a level piece of ground to stand on when he is free in a grass field, and much more ought he to have it in a stable, which is his place of rest.

Transversely to, and behind the stalls, there should be an open way or drain running the whole length of the stable, as close as convenient to the hind posts. Between each pair of stall posts, in the line of this drain, should be an iron grating, not less than a foot square in the clear, with a cesspool below, as shown in Plate IX. and not less than two feet deep, and lined with cement, from this the liquid-manure drains should be laid.

Ventilation.—This is one of the most important points to be attended to in the construction of the lodgings of all cattle, but with no animal is it so important as with the horse.

The doors and windows are usually the only apertures through which the exhalations from the stable can find a way out; and in the winter time, when these are necessarily closed

to keep the animals warm, the stable is found to be in a most unhealthy state. I cannot do better than quote Mr. Stephens's description of the general state of farmers' stables. He says,—“It is distressing to the feelings to inhale the air in some farm stables at night, particularly in old steadings economically fitted up. It is not only warm from confinement, moist from the evaporation of perspiration, and stifling from sudorific odours, but cutting to the breath, and pungent to the eyes, from the decomposition of dung and urine by the heat. The windows are seldom opened; and many can scarcely be opened by disuse. The roof, in fact, is suspended like an extinguisher over the half-stifled horses. But the evil is still further aggravated by a hayloft, the floor of which is extended over and within a foot or less of the horses' heads. Besides the horses being thus inconvenienced by the hayloft, the hay in it, through this nightly wasting and fumigation, soon becomes brittle, and contracts a disagreeable odour.” This is not an exaggerated statement, as I have found work-horse stables in most old steadings to be in quite as bad a state as he describes.

The great point to be attained in ventilating these buildings is to give an ample supply of fresh air without causing a positive draught; and this is best done by building into the wall, close to the ceiling joists, iron air-bricks. Of these bricks—if the same size as an ordinary sized brick, *i. e.* $9 \times 4\frac{1}{2} \times 2\frac{1}{2}$ inches—one should be allowed for each horse; and for every eight horses there should be a proper ventilator through the roof of not less dimensions than would contain 36 cubic feet of air. The sides of the ventilator should be fitted with louver boards, set at a very acute angle to the jamb. This will effectually keep out all violent draughts, and prevent rain and snow from beating in. At the bottom of the ventilator should be placed a wire-gauze flap, as described in the article on Ventilation, and attached to it a cord and pulley, by which the opening may be adjusted

PLATE IX.—*Cart-Horse Stables.*
Transverse Section and Plan.

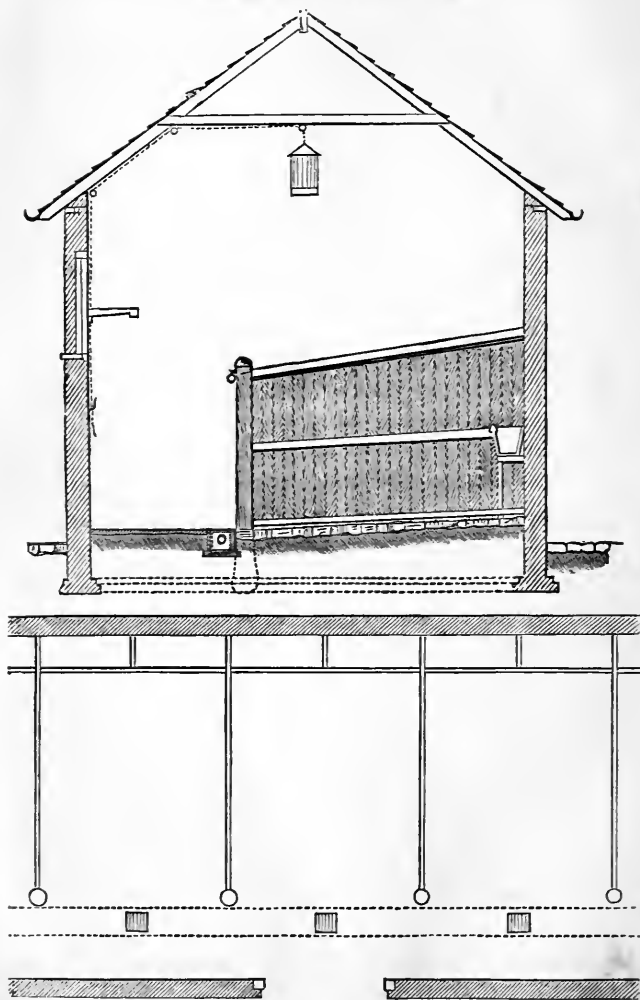
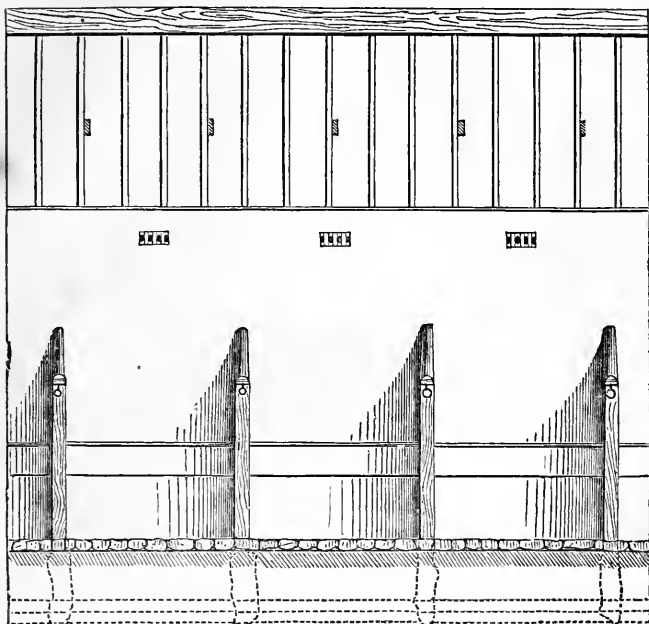
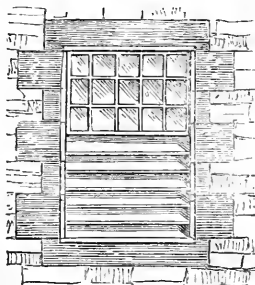


PLATE X.—*Cart-Horse Stables.**Longitudinal Section.**Fig. 2.—Stable Window.*

according to the state of the weather. When these ventilators are used there need be no louvre boards in the windows, but if not, the window should then be divided into three compartments by mullions, the two side divisions being fitted with glass, and the centre one with louvre boards with adjusting rack, or as in *Fig. 2*.

In a large stable I myself erected, this ventilation was found to answer tolerably well, the fresh air being admitted by the louvre boards in the windows, and the foul air emitted through the air bricks, two bricks being allowed for each horse; but I should decidedly recommend that ventilating hoppers be always fitted in the roof, and the fresh air supplied through openings in the lower part of the walls, the apertures covered with perforated zinc. By these means an equal temperature, with perfect ventilation, may be preserved both winter and summer.

Cart-horse stable doors should be made in two halves, an upper and lower. A thumb-latch, and a good lock and key should be provided. The manner of storing and supplying the food to horses is rather an important point. In stables generally there is a large bin or chest in which the corn is kept, but in constructing new buildings for this purpose, it is much better to arrange for a small separate apartment for mixing and preparing the food. This is the more necessary when the practice is to mix the corn with chaff.

This should be done by the bailiff or foreman, and the allowance delivered out to each ploughman or carter for his particular team of horses, thus putting an end to some of the malpractices so well known to exist by all persons who have much employed this class of men and horses.

In this room, called the horsekeeper's room, should be kept, in a closet, any small necessities occasionally required in the stable, and amongst these the requisite medicines, balls, &c., to be ready in case of horses being taken suddenly ill.

Plates IX. and X. are the plan and sections of a cart-horse

stable, constructed in an economical and substantial manner, and the following are the quantities and estimates for constructing the same :—

	£	s.	d.
20 yards cube excavation at 3 <i>d.</i>	0	5	0
3 $\frac{3}{4}$ rods of reduced brickwork at 8 <i>l.</i> 10 <i>s.</i>	31	17	6
40 in. run of brick, on edge, in cement at 4 <i>d.</i>	0	13	4
40 in. run of cement filleting at 2 <i>d.</i>	0	6	8
10 $\frac{1}{2}$ square of slating at 20 <i>s.</i>	10	10	0
48 in. run of ridge to ditto at 6 <i>d.</i>	1	4	0
672 in. superficial of paving to stable, &c. at 1 <i>s.</i>	33	12	0
7 inch cube of stone sills to doors at 2 <i>s.</i>	0	14	0
90 ft. superficial of inch-ledged doors at 4 <i>d.</i>	1	10	0
407 ft. superficial 1 $\frac{1}{2}$ -matched and beaded boarding to stalls at 5 <i>d.</i>	8	9	7
19 ft. 6 in. cube wrought oak posts, &c. at 4 <i>s.</i> 6 <i>d.</i>	4	7	9
84 ft. cube fir joists, rafters, &c. at 1 <i>s.</i> 6 <i>d.</i>	6	6	0
30 ft. cube wrought fir door and window frames at 1 <i>s.</i> 7 <i>d.</i>	2	7	6
22 ft. 6 in. superficial louvre boarding to windows to open and shut at 7 <i>d.</i>	0	13	0
11 ft. 6 in. superficial glazed sashes at 1 <i>s.</i> 9 <i>d.</i>	0	19	11 $\frac{1}{2}$
20 ft. run $\frac{3}{4}$ -rounded fillet at 1 $\frac{1}{2}$ <i>d.</i>	0	2	6
10 $\frac{1}{2}$ square of slate boarding at 7 <i>s.</i> 6 <i>d.</i>	3	18	9
60 yards superficial of painting, in 3 oils at 6 <i>d.</i>	1	10	0
No. 2 heads, at 6 <i>d.</i> , and 2 shoes, at 6 <i>d.</i>	0	2	0
130 yards superficial twice lime white at 1 <i>d.</i>	0	10	10
96 yards run 3-in. guttering zinc at 3 <i>d.</i>	1	4	0
18 yards run 2-in. rain-water pipe do. at 4 <i>d.</i>	0	6	0
No. 2 heads, at 1 <i>s.</i> 10 <i>d.</i> , and 2 shoes, at 1 <i>s.</i>	0	4	8
40 brackets and nails to ditto at 4 <i>d.</i>	0	13	4
Manger complete and fixed 1 <i>s.</i> 6 <i>d.</i> per foot run	3	12	0
3 10-inch stock locks, at 1 <i>s.</i> 9 <i>d.</i> , 3 stable latches, at 1 <i>s.</i> , 16 manger rings, at 4 <i>d.</i> , 8 stable grates, at 10 <i>d.</i>	3	19	9
2 ventilators in roof, with moveable louvre boarding, painted and fixed complete	4	0	0
	<u>£90</u>	<u>7</u>	<u>3$\frac{1}{2}$</u>

The above shows a cost of £11 6*s.* per horse.

All the interior fittings of the stable are manufactured separately of iron and other materials, but they are chiefly adapted for hunting, carriage horses, or nags' stables; the cost rendering them inappropriate to the lodging of cart horses.

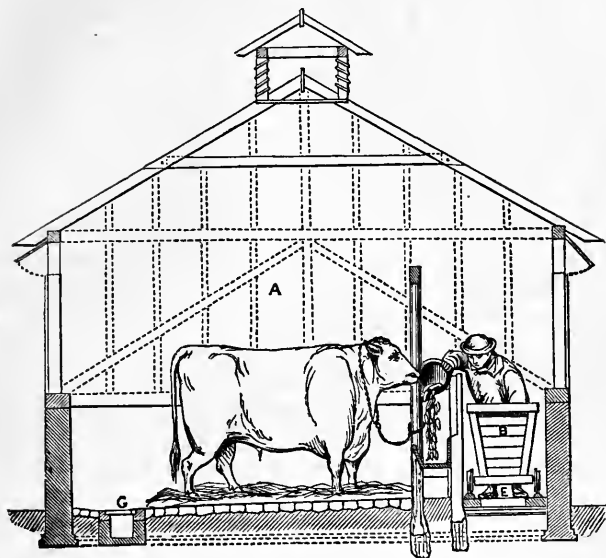
The paving of stables is done in a variety of ways, depending chiefly upon the local materials, such as faced flints, blocks of the harder description of chalk, or a chalk puddle primed in. Moore stone is used in the southern counties of England, and is one of the best materials I know for the purpose. Clay and smiths' ashes make a very good bullock-shed floor, but it does not last under heavy horses. Wood blocks are good, but absorb urine to too great an extent. Kamptulicon has been proved in cavalry stables to be the most perfect floor. I have just paved my own stable with slate cuttings set edgeway, with cement—it is both good and durable. Behind the horses, from the drains to the walls, I prefer a pavement of hard bricks; the liquid-manure drains should be glazed earthen pipes, or what is known as Vauxhall stone ware.

BOXES AND STALLS.

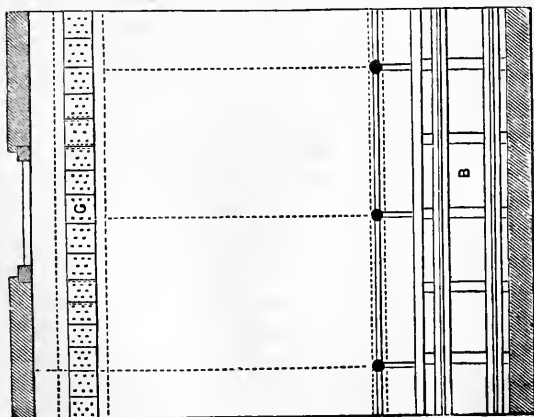
The Bullock-fattening Shed.—Throughout Switzerland and Flanders the practice has long existed of keeping the cattle constantly in the house, where they are fed upon cut grass, clover, and other green food. This is a most excellent mode of procuring rich manure, and the plan is as profitable to the feeder as it is good for the stock.

The practice of stall feeding or soiling has been gaining ground for many years, owing chiefly to the successful results of the system as proved by the late Earl Spencer, the Duke of Richmond, and other noblemen, who have carried out experiments on a great scale, to test the merits of the plan, and no homestead can be considered perfect that has not proper and scientific arrangement made for the soiling of stock; the general opinion being now decidedly in favour of fattening all stock in covered, comfortable sheds, in pre-

PLATE XI.—*Bullock-fattening Shed.*
Transverse Section.



Plan.



ference to their remaining in the open air. Young animals, requiring exercise, will generally grow better, and more vigorously, in the open pasture, than when confined to sheds or courts, but this is not the case with animals fattening, as warmth and rest are the most conducive to that operation, and these can only be obtained by stall feeding. It is now proved beyond a doubt, that a bullock gets fat much sooner, and consumes much less food in doing so, in a shed or stall, than in the open field.

In their anxiety to carry out this system in the best and most efficient manner, many of the noblemen and gentlemen who have adopted it have laid out extravagantly large sums in the erection of their bullock sheds, or stalls, such as no farmer could afford to pay interest for. Indeed, I have myself observed on some estates, that a larger sum has been

Fig. 3.

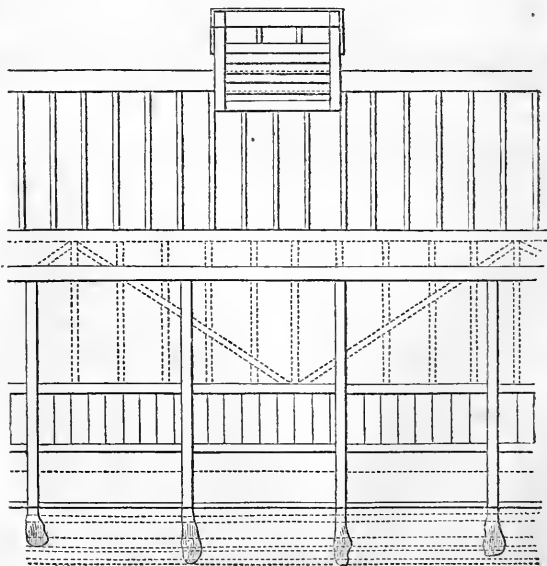
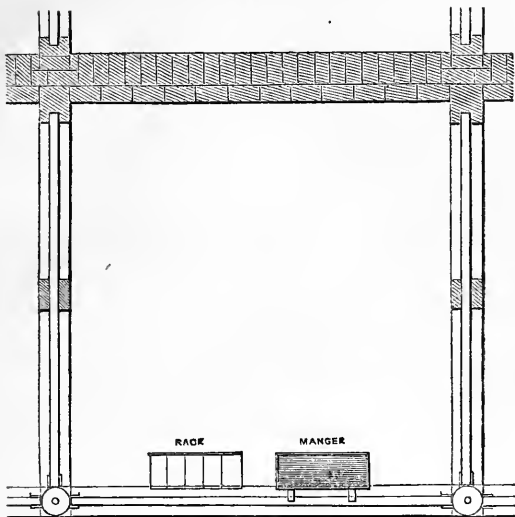
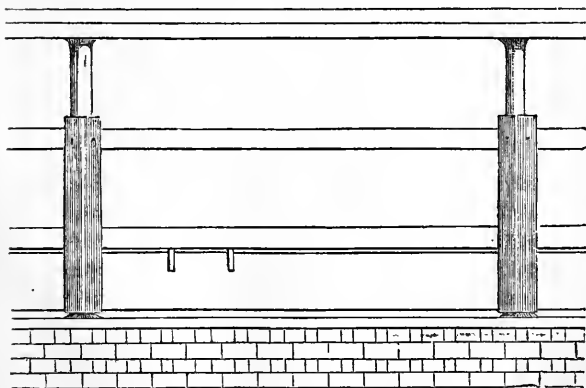


PLATE XII.—*Design for a Loose Box.**
Plan.



Elevation.



* This design for a loose box is copied from one by J. Ewart, Esq., in the Journal of the Royal Agricultural Society for 1850.

expended for the accommodation of a single bullock than for that of a whole family of labourers.

Warm, dry, and well ventilated cattle sheds have been constructed in many places at a very small cost, and it is to these that the practical farmer must look for example ; the following being the chief points to be attended to :—

1st. That the lodging of the animals be dry, warm, and well ventilated, with arrangements for maintaining as nearly as possible an equal temperature.

2nd. That the arrangements for supplying the animals with litter and food be such as will most economize the labour of the cattleman, and there should be equal facility for removing the manure from the sheds and stalls.

3rd. That cesspools and liquid-manure drains be so arranged that not a drop is wasted.

4th. That all this be done at the smallest possible cost.

Fig. 4.—Section.

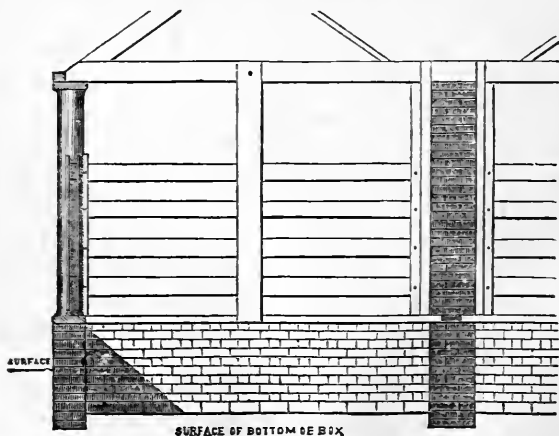


Plate XI. is a plan and section showing the accommodation for one animal, and *Fig. 3* is a longitudinal section of the same, which may be continued to any length.

A, is the lodging of the animal, which should be arranged for each bullock to have to itself 5 feet of width. This should be paved with some hard material, the nature of which will generally depend upon locality. (For description of material for flooring cattle-feeding sheds, see the article on Floors.)

Each animal will be secured in his position by a chain or strap round the neck. This is fastened to a ring which slides freely upon the circular post C, the lower end of which is let into the floor, and the upper end securely fixed to the joists of the floor above. Should there be no loft over, a strong rail must be run the whole length of the shed, and be occasionally secured to the wall by a transverse tie; into this the heads of the stall posts must be securely tenoned.

B, is a space railed off, 4 feet wide, for the purpose of enclosing a single line of rails, upon which a truck runs for supplying the animals with food of various kinds.

In the ground plan of the example steading, Plate VI., it will be observed that this line of rails runs right up to the coppers to receive the cooked food, as well as to the chaff-house and the different root stores, the turnip cutter, and gorse bruiser. This should always be done, and if possible a straight line should be preserved, as the cost and inconvenience of turn-tables is considerable.

E, is the line of rails for the truck, and is here shown as cast upon the top of an iron pipe. These pipes are for the purpose of containing hot water or steam to warm the building in exceedingly cold weather.

I have thought it necessary to make these provisions in consequence of the principle being now thoroughly established, (a fact that farmers cannot be too often reminded of,) that warmth is equivalent to food, and that if they allow their fat

stock to suffer from cold, they are throwing away a proportionate quantity of food.

Between the stall posts and the rail are placed the feeding troughs. There should be two of these to each animal—one to contain the food, the other the water.

At the back of the trough, behind the railing, should be placed a pipe for supplying water to the trough, with a separate tap to each animal.

The plan is often adopted of keeping the water in all the troughs at a uniform level, by means of a cistern and ball cock at one end. The taps are the only saving, and as it is exceedingly inconvenient, it is a plan that cannot be recommended.

Behind the animal, running lengthways of the building the whole length, is the liquid-manure drain, G. This is 15 in. wide and 18 in. deep, built of brick and lined with cement, the top is covered with small boards, placed transversely across and bored with holes.

I consider this mode of constructing the drain to be the best, as it can be made of any materials, be easily cleared out, and affords ample opportunity for the liquid to flow through to the drain when there is a large quantity of dung on the floor.

The front of the shed next the yard is shown as constructed of brick to 4 feet from the ground; above that it may be weather boarded. It is sometimes constructed of spars, 3 inches wide, placed 3 inches apart, but by this plan I have always found the sheds very cold in the winter. Weather boarding is best up to within a foot of the top, where it may be open sparred work with a board hung on hinges, to be open or shut at pleasure, according to the temperature, as shown in Plate XI.

This plan is designed under the supposition that the stalls will be cleaned every day or two. If it is intended to allow the dung to accumulate under the animal, and the clean litter to be always put on the old, there will then be required dif-

ferent arrangements for the feeding, as the troughs must be made to shift up as the manure increases in thickness. There was an arrangement of this sort at Mr. Mechi's, ingeniously done, but I should decidedly not recommend the plan of allowing any great accumulation of dung in sheds of this description, it is much better to have sunk stalls, or boxes.

This is a very favourite plan with many persons; it has however one great objection, that is, the cost of constructing the boxes, and I have not seen any corresponding advantages. If two animals are put into one box and tied up, as is often done, they might just as well be in an ordinary shed; as the principal advantage said to be derived from box feeding is to use it as a loose box, and allow the animal to turn about and lie down just which way he pleases. I have, however, seen animals of the largest kind fatted, without any discoverable inconvenience, side by side in large sheds.

Quantities and Estimate for Eight-Stall Bullock Shed.

		£	s.	d.
10 yards cube of excavation to foundations	. at 3d.	0	2	6
1 $\frac{2}{3}$ rods superficial of reduced brickwork	. at 8l. 10s.	13	13	4
64 yards superficial of paving to stalls	. at 1s.	3	4	0
9 $\frac{1}{2}$ square superficial of Countess slating	. at 20s.	9	10	6
42 feet run of ridge to ditto	. at 6d.	1	1	0
32 yards superficial of twice lime white	. at 1d.	0	2	8
38 feet cube of oak sawn die square	. at 4s. 9d.	9	0	6
31 feet cube of oak wrought all round	. at 5s. 6d.	8	10	6
40 feet superficial of inch oak	. at 10d.	1	13	4
122 ft. 4 in. cube of fir, rafters, plates, &c.	. at 1s. 6d.	9	3	6
11 feet cube of fir, wrought	. at 1s. 9d.	0	19	3
9 $\frac{1}{2}$ square superficial of slate boarding	. at 7s. 6d.	3	11	3
2 $\frac{1}{2}$ square superficial of $\frac{3}{4}$ weather boarding	. at 16s.	2	0	0
212 ft. 6 in. superficial of 1 $\frac{1}{2}$ -inch wrought boarding	at 8d.	7	1	8
80 feet superficial of inch flap hung	. at 6d.	2	0	0
60 feet superficial of inch ledged door	. at 9d.	2	5	0
Carry forward		73	19	0

		£	s.	d.
	Brought forward	73	19	0
No. 12 pair of hooks and bands, at 1s. 6d., 2 Norfolk thumb latches, at 7d., 2 9-inch barrel bolts, at 9d.			1	0 8
84 feet run of 3-inch cast-iron eaves guttering	at 4d.	1	8	0
32 feet run of 2-inch cast-iron rain-water pipe	at 5d.	0	13	4
No. 2 heads, at 1s. 10d., 2 shoes, at 1s.		0	4	8
14 yards run of railway	at 4s. 6d.	3	3	0
30 yards superficial of painting in 3 oils	at 6d.	0	15	0
		<u>£83</u>	<u>2</u>	<u>8</u>

The above shows the cost to be £10 7s. 10d. per bullock.

Plate XII. is a plan and section of a loose box, 9 feet square. This is the size considered the best by authorities upon the point, and I think it would be a false economy to make them less. The floor of the box is sunk 18 inches below the door sill, and is well paved. As has been before observed, the animal stands in this box upon the manure, which is not removed, but fresh litter continually added, and doubtless the manure from being so thoroughly compressed is subject to little loss, and will be in an excellent state when taken out; but I cannot agree with some authorities, that this plan is the most economical method of making beef.

That animals can be fatted more economically in well sheltered, comfortable, and dry buildings than in wet, cold yards cannot be questioned, and we may with advantage quote the excellent remarks of Mr. Ewart upon this subject, in his Essay on Farm Buildings, in the Journal of the Royal Agricultural Society for 1850.

“The generally imperfect management of fattening stock, and the negligent preparation of manure so prevalent in times past, cannot enable the husbandman of Britain to meet, without diminution of capital, the unrestricted competition of foreigners in the British market in every kind of produce of the soil which he will henceforth have to encounter. The

excrements of a few half-fed wintering cattle, and the litter of an open yard exposed to the alternate effects of rain, wind, and sunshine, will do little in raising such grain crops as to enable the British farmer to maintain, much less to promote, a profitable employment of his capital, and of native industry in the cultivation of the soil. Nor will the estate of the landed proprietor be supported in its present value in the absence of accommodation for the fattening of cattle with the greatest economy and convenience for preparing manure without waste of its fertilizing properties.

“The essential conditions on which the fattening of cattle can be obtained with the greatest economy, are warmth, quietude, wholesomeness of atmosphere, and cleanliness. And of all accommodations that have probably ever been invented for the feeding of oxen, none has so completely answered the principal object of converting the vegetable productions of the earth into food for mankind in the shape of flesh, as the plan of feeding in boxes or loose stalls, first suggested by Mr. John Warnes, of Trimmingham in Norfolk; nor does any plan more completely fulfil a secondary but scarcely less important object, the raising manure of the best quality with the greatest economy, than the accommodation alluded to. There cannot exist, in the mind of any individual who may have witnessed the feeding of cattle in boxes properly carried out, a doubt of its being a most effectual mode of providing due shelter, perfect freedom from molestation, and complete comfort to the animals—all conditions most essential to rapid thriving; nor can any one behold the accommodation without being thoroughly convinced of the great economy in collecting the egesta and preserving it in the very best state for its purposes, and yet without the least exhalation of effluvia. Whatever may be supposed, those who have not seen the box-feeding system in operation are hereby assured by the writer, who has carefully watched its effect, that it is in every respect consistent with perfect cleanliness, and perfect health of the

beasts ; and he must, without hesitation, state his belief that, whenever any objection has been raised to the system, it has been induced from having seen boxes of improper construction and fitting, or perhaps from excess of moisture produced from rain from above or from springs from beneath. As to the latter observation, respecting excess of moisture, the writer is certain of the fact, that a sufficient quantity of dry litter supplied three or four times a week, to keep the animals clean from the solid excrement, is sufficient to completely absorb the whole of the urine they void. Before having had an opportunity of judging correctly of the fact, the writer was certainly of opinion that supersaturation of the litter with urine would soon take place, but thorough conviction of the contrary has been induced by actual experience.

* * * * The writer is so thoroughly convinced of the important advantages to be derived from feeding cattle in separate boxes, under cover of a roof, that he suggests that system as the best he ever witnessed or heard of, in the plan he submits to the Society in competition for their valuable premium for the best essay on farm buildings."

I have quoted Mr. Ewart as an able advocate of the system of feeding cattle in boxes ; but, as I have before observed, there is considerable difference of opinion upon this subject, and Mr. John Caird, of Baldoon, whose opinions *on practical points of his profession* ought always to be listened to with attention, evidently prefers stall feeding to any other system, for, in his book describing a tour through the West of Ireland, he has the following remarks on stall feeding :—

"A considerable comparative experience has convinced me that no other method will give equal accommodation for the same outlay ; whilst I am also persuaded that, in regard to economy of food and litter, facility of labour in attendance, health and progress of the cattle, and systematic arrangement altogether, stall feeding is superior to any other that has yet come under my notice. The progress of the soiling

system, or house feeding of cattle in summer as well as winter, will lead to a more general recognition of the superiority of stall feeding, both from the necessity of economizing litter and the advantages of not wasting the labour of the cattle feeders and others in traversing unnecessary distances while attending to the stock."

COW BYRES.

The arrangement of the stalls described as for fattening bullocks will answer the purpose equally well for milch cows. Not so the cattle boxes, though boxes are occasionally used for the purpose.

The stalls for cows should not be less than 8 feet square, to hold two cows.

If a travis is placed between each pair of stalls, it is better to construct it of wood—stone being injurious to the cows. The manger should be about 20 inches from the floor, although often placed on the ground; but Mr. Stephens considers this plan "highly objectionable, inasmuch as when biting the turnips the head of the animal is depressed so low that an undue weight is thrown upon the fore-legs, and an injurious strain induced on the muscles of the lower jaw."

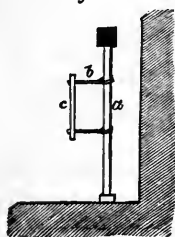
The arrangements for feeding milch cows are pretty much the same as those for beasts. A plan is often adopted, in the North of England, of supplying the animals with their food through a hole in the wall, opposite their heads; but draughts of cold air, entering through the opening right upon the animal, must be highly injurious. Decidedly the best plan is to have a pathway between the wall and the animals' feeding trough.

In some recently erected cow byres the animals are arranged in two rows, with their heads towards each other and a path between them; but there are several objections to this plan, especially that of the animals continually breathing upon each other. The paving of the cow byre should be

with pitched stones for about half the length of the stall, and the other half should be of rammed earth; as cows, in lying down or rising up, first kneel on their fore-knees, which would be injurious if the floor were not made smooth as well as covered with litter.

The method of fastening the cows is the same as for bullocks, viz., a chain with a ring sliding up and down the head post, or a chain and ring, and a strap round the animal's neck. The Scotch plan is generally by what is called a Bakie, shown in figure 5. This is composed of a piece of

Fig. 5.



hard wood, *c*, with two pieces of cord fastened at the top and lower end; the bottom cord has an eye spliced in the end and round the post *a*, up and down which it moves freely. The upper cord has an eye and knot, *b*, where the animal is tied up; the lower end is passed under the neck, and the upper one over; it is then secured to the post. This is a good method of tying up, but not so good as the chain, as the animals are prevented turning their heads to lick their bodies, which they can do by the former plan.

Another plan of fastening cows, is by a spar of wood shifting in a slot at the top. The animal's head being thrust in when it is open, it is then drawn up to the animal's neck, and fastened. This plan is never to be recommended but for some temporary purpose.

CALF PENS.

Calves are either suckled by the mother or artificially brought up by hand, by feeding them with milk, linseed tea, &c.

When suckled by the mothers, and there is room enough in the cow byres, they are best arranged in a row behind the cows; and, if not, they are placed in separate loose boxes at

the end of the byres, and let loose at proper intervals to be suckled. Some persons object to the placing the calf cribs in the same byre with their mothers, on account of the elder animals being disturbed by the bleating of the young; but there is no foundation for this prejudice, as in practice it is not the case.

When brought up by hand they are placed in a separate apartment, and sometimes each calf is placed in a separate crib; a plan which has the advantage of preventing them sucking one another, from which bad practice diseases are often engendered. A single calf crib should not be less than 4 feet square and 4 feet high, formed by a frame of light spars, and provided with a wicket for access to the pen. The floor should be paved with some hard material such as asphalt, and every provision should be made for keeping the place clean and sweet.

A most disagreeable smell is always found to exist in the apartments occupied by calves, and no arrangement is ever used to get rid of it; some low shed, without light or ventilation, being generally appropriated for this purpose.

The most ample ventilation should always be secured, by the apartment being of a sufficient height, and provided in the ceiling and roof with an aperture covered with perforated zinc. The walls should be periodically lime-washed, and the apartment be kept thoroughly clean.

In Marshall's Survey of Gloucestershire, he describes the plan adopted for feeding calves; and as it is much used at this time, and is, I believe, the original of the system of feeding cattle on sparred floors, as adopted by Mr. Huxtable and Mr. Mechi, I have given it below. Mr. Huxtable, however, has the credit of being the inventor, although the plan has been used in Gloucestershire from time immemorial.

The calf pens in Gloucestershire, Marshall observes, are of admirable construction, extremely simple, yet singularly well adapted to the object. Young calves, fattening calves more

especially, require to be kept narrowly confined ; quietness is, in a degree, essential to their thriving. A loose pen, or a long halter, gives freedom to their natural fears, and a loose to their playfulness. Cleanliness and a due degree of warmth are likewise requisite in the right management of calves. A pen which holds seven, or occasionally eight calves, is of the following description : The house or roomstead, in which it is placed, measures 12 feet by 8 ; 4 feet of its width are occupied by the stage, and one foot by a trough placed on its front, leaving 3 feet as a gangway, into the middle of which the door opens. The floor of the stage is formed of laths about 2 inches square, lying the longway of the stage, and 1 inch asunder. The front fence is of staves, an inch and a half in diameter, 9 inches from middle to middle, and 3 feet high, entered at the bottom into the front bearer of the floor (from which cross joists pass into the back wall), and steadied at the top by a rail ; which, as well as the bottom piece, is entered at each end into the end wall. The holes in the upper rail are wide enough to permit the staves to be lifted up, and taken out to give admission to the calves ; one of which is fastened to every second stave by means of two rings of iron joined by a swivel, one ring playing upon the stave, the other receiving a broad leathern collar buckled round the neck of the calf. The trough is for barley meal, chalk, &c., and to rest the pails on. Two calves drink out of one pail, putting their heads through between the staves. The height of the floor of the stage from the floor of the room is about one foot. It is thought to be wrong to hang it higher, lest by the wind drawing under it the calves should be too cold in severe weather : this, however, might be easily prevented by litter or long strawy dung thrust beneath it. It is observable, that these stages are fit only for calves which are fed with the pail, not for calves which suck the cow.

This plan approaches very nearly to the sparred floors of Mr. Huxtable. The main pit being made deeper is decidedly

an advantage. Unless it be raked out every day, the pit will require to be sprinkled with some fixer, as often as convenient, to keep the place sweet and preserve the quality of the manure. For the details of the construction of these floors, see the chapter on Sparred Floors.

THE PIGGERY.

There is no animal on which the farmer is more inclined to bestow care and attention than on his hogs. They have always been a favourite stock; their general inclination to fatten, short life, and consequently quick return for the outlay, very justly rendering them so.

As to the best arrangement for the lodging and feeding of hogs, almost every man has some particular notion; sometimes they are to be found lodged in the most costly buildings imaginable, and at others scarcely protected from the weather.

That hogs, as well as other animals, require good and sufficient accommodation, there can be no doubt; it is of the first importance that they be kept warm and dry: modern science has proved that a less amount of food will suffice to produce the same results, when so cared for.

They should also be kept exceedingly clean—for the hog is not naturally of dirty habits—and if provided with plenty of clean straw, and a separate lodging, will always be found in a clean state, and amply repay any extra care or attention bestowed upon him.

The sties should not be too large, and should be open, if possible, to the south; they should be divided into two parts—an open yard, and the lodging.

The yard should be conveniently placed for the removal of the large amount of dung made by these animals; it should be surrounded by a strong flush oak fence, or brick wall, and be securely paved; as these animals will root up and entirely destroy the premises in a very short time, if precaution be

not taken to prevent them. They should also be prevented from seeing into the adjoining yards or lodgings.

The lodgings should be raised above the outer yards, and be well protected from the weather, (rain beating in upon hogs is the worst thing that can happen to them,) they should be well ventilated and drained, and the floor should have a good slope towards the yard.

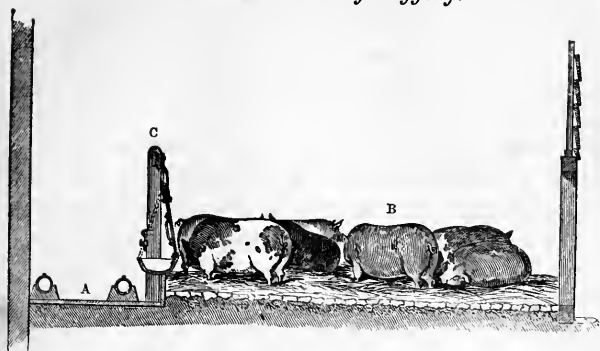
The feeding arrangements are usually placed at the end of the yard, and are loose wood, or iron, open troughs. For small piggeries circular iron troughs, divided into compartments, is a excellent plan. The ordinary triangular troughs in common use are the worst; about one-third of the food being wasted by the hogs splashing it over in their greedy anxiety to get more than their proper share, and sometimes a pig may be seen lying lengthways in the trough, thinking by that means to secure himself a larger share. Such a system of feeding would not be tolerated in any well managed farm, though I am sorry to say it is an ordinary plan. Some contrivance should always exist to separate the hogs and provide for each having its proper allowance, and for the feeder to be able to properly fill the trough before the pigs get at it, which it is difficult to do by the old plan.

An excellent iron trough is made by Crosskill, of Beverley, Tor's patent, for this purpose. The plan is not new, as an extensive and costly piggery, erected at Bagshot Park Farm, by his late Royal Highness the Duke of Gloucester, is fitted with a similar apparatus, but of wood. It is much better to be constructed of iron, if possible, and it should be fitted into the fence, and form part of it.

Fig. 6 is the section of a sty, showing the arrangement for feeding.

A, is the passage for the feeder, which will be equally necessary whether the truck and rail be used or not. B, is the lodging for the hogs. This, as well as the outer yard, should be paved in a secure manner, perfectly smooth, and

Fig. 6.
Transverse Section of Piggery.



without cracks or fissures of any kind, and sloping easily towards the yard.

The floor of the lodging should be worked up to a sill between it and the yard, which should be about four inches lower. Each lodging should slope slightly towards the centre, as well as towards the yard; so as to ensure the most perfect drainage. C, is the post-and-rail fence that separates the hogs from the gangway. The space between the posts is filled up with the hog feeding-trough. This may be constructed of iron or wood, and consists of a circular bottom trough, running the width of the sty, divided by plates across, which prevent the animals pushing one another away, and allows the food to run through the hole at the bottom of it, from end to end, when being filled. Above the centre of the trough is suspended, and swinging, a flap 2 ft. 6 in. deep, which, when the troughs are being filled, is pushed forward towards the hogs and secured there. After the food has been placed in readiness, the flap is withdrawn towards the feeder, and secured to that side of the trough. It then forms an excellent back, and prevents the

least waste from the food being splashed over. In some cases, I have seen this flap fitted to rise in a slot, so that it may be removed from one side to another when the trough is quite full, which, with the ordinary method, cannot be done.

Sometimes these flaps are made of laths; but it is not nearly so good as to have them flush.

SHEEP SHEDS.

The great success that has attended the system of fattening oxen in stalls, or covered sheds, has led many persons to try experiments as to the effect of the same system, as applied to the fattening of sheep, and generally with successful results; for warm and dry lodging is as necessary to sheep as to other animals.

The gentleman who has carried out this plan on the largest scale, and whose efforts to introduce the system are most looked up to, is Sir Richard Simeon, Bart., on his farm in the Isle of Wight. The plan adopted there is to tie up the sheep separately, exactly the same as bullocks; each sheep having a separate stall, and being fastened with a chain like an ox. The sheep are fed upon oil-cake, cut turnips, meal, &c., from a feeding box, and water is supplied to them from a trough. Behind the animals is placed a manure tank, into which the manure is swept several times during the day. The tank is covered with a grated cover.

The shed is kept at an even temperature, and experience has shown that a much higher temperature than one would expect is the best for fattening. The thermometer, therefore, should be kept exactly at this point.

The plan of shed-feeding is now fast gaining ground, and arrangements of some kind for it are now made in all new homesteads.

Different persons advocate different plans. Mr. Mechi, Mr. Huxtable, and others, have the sheep-shed floors covered with a grating, through which the manure falls, and is occa-

sionally removed. For a description of these floors, see chapter on Sparred Floors.

On some farms the sheep are fed in sheds, the floors of which are excavated below the level of the ground, the same as for box-feeding large animals; the litter is spread over the dung, which is first sprinkled over with dry ashes, gypsum, burnt clay, or some other fixer. This plan is in no way so good for the sheep as the other, which may be called the dry plan, nor is it much in use.

The ordinary mode is now to have large, comfortable sheds, with hard paved floors, in which the sheep are supplied with food in much the same way as in other places, but with this difference, that the animals have full liberty to move about.

It may easily be imagined that the dung from animals fed in this way, that is, under covered sheds, is found to be of the utmost value as manure, and that it has greatly the advantage over the field plan, where half the value of the manure is lost from evaporation of the ammonia in warm weather, and the washing it is subjected to in wet. The important argument formerly brought against this plan on light lands, viz., that the consolidation of the soils by the tread of the sheep was lost, now no longer holds good, for nearly the same effect of the tread of the sheep is produced by the use of Crosskill's toothed roller.

A good arrangement has been made by tying the sheep up in pairs; and, in consequence of the sociable nature of the animal, benefits are said to be derived from it. Economy in construction also takes place, as only one water and feeding trough is required instead of two, and a larger number of sheep may be accommodated in the same sized shed.

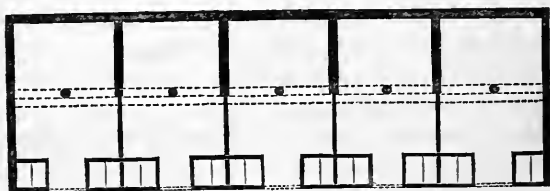
On wet farms there is no doubt that the sparred floor sheep-sheds are most excellent, and of the greatest possible advantage, as the sheep may feed on the land in the day

without injury, if certain of having a thoroughly dry bed at night: their occasionally being wet is of no consequence, the mischief is in their being continually so.

Bull House.—A separate box must be provided for bulls, which may be constructed in the same manner as for fattening oxen, except that it should not be less than 12 feet by 9.

Cattle Hammels.—In many parts of the north of England, and generally in Scotland, the plan is to feed cattle in hammels. These are small apartments with little yards attached, in which one or more animals are placed, and usually suffered to range in and out of the yard as they please. There needs no particular description of these buildings, as they have no particular fittings up or arrangements, more than an ordinary small shed and yard. Their chief use is in affording accommodation for growing stock; and on farms where much is bred it is necessary to have them. Young growing animals will not thrive so well if subjected to much confinement.

Fig. 7.—Plan of Hammels.



Cattle Infirmary.—This is a new feature in farm homesteads; but, nevertheless, I think no good steadings will long be without it. The dreadful ravages that have taken place lately (especially since the introduction of so much foreign stock) render this building now positively necessary, with a view to prevent the spread of dreadful disorders. By pleuro-

pneumonia alone a large amount of stock has been destroyed, and in this, as in many other diseases, it is of the utmost importance to have the animal supposed to be affected immediately removed to a separate lodging and yard, inaccessible to any portion of the other stock upon the farm. Different animals require different and peculiar treatment, while suffering from certain diseases, and this can only be effectually carried out by having separate and fit accommodation for them. The cattle infirmary should be placed at some portion of the steading, not in the road of the ordinary stock, and having a separate way to it, and be so situated that the manure from the animals in it may be removed direct to the dung heap or house, that the feet of other animals may not come in contact with it.

The buildings should consist of a loose box for horses, a stall for oxen or cows, a sty and yard, and a small lodging and yard for sheep, surrounded by a high close fence. The floors should be laid with Kamptulicon, or asphalte, as being the least absorbent materials in use. The walls and ceilings should be plastered, and floated as smooth as possible. The troughs, racks, and mangers should be of iron; and wherever there is any woodwork that may come in contact with the sick animal, it should be planed smooth. The whole place should be lime-whited every time cattle are placed in it. Some arrangement should be made for producing extra warmth, if necessary, and the whole should be most perfectly ventilated.

STRAW YARDS.

In the plans of old steadings the buildings are generally arranged round an enclosed area, called the straw yard, and this yard will be found to exist at the present day, with all its abominations, on nine farms out of ten in England, especially in the south.

It is in this yard that the generality of farmers consider that

the manure is to be made for producing the crops, from the sale of which they are to meet the expenses of the farm, themselves to live, and get, if they can, something towards increasing their capital. One would think, as so much is to be got from this part of the premises, considerable pains would be bestowed in having it constructed and arranged in the best possible manner for the purpose required; but it is not so—the straw yard of most English farms is a partially enclosed place not paved, nor even the bottom formed to any regular shape, unfurnished with any means of draining the liquid manure towards a tank, or protected from the rush of water descending into it from thousands of feet of roofing that surround it, after heavy rain or the melting of snow. Into this yard, or rather pool of stagnant water, tons of valuable fodder in the shape of straw are thrown to form a bed for the stock who are unfortunately doomed for a time to wallow in its filth. The whole of the rain water being allowed to drain into the yard would of course soon flood it, in spite of the continually renewed layers of straw that are added, fresh and clean and dry, to be water-rotted, saturated, and wasted.

To prevent this accumulation of water at the lowest point, it is usual to have a horse pond, into which the water, after thoroughly washing the manure and extracting from it its most valuable elements, eventually finds its way; and the drinking pond, instead of being wholesome and clean, is a rude tank of diluted liquid manure. When this exceeds a fixed height, as it will do of course after every shower, a noisy little torrent makes its way to the adjoining brook, carrying past the farmer's door the very profit that he is working so anxiously to obtain. This wretched straw yard is about the worst part of these miserable steadings, and the farmers are not always to be blamed for it. I have frequently pointed it out to them, and invariably the reply has been "What can I do? the whole of my buildings must have gutters to carry off the rain water, before these gutters are fixed the broken eaves of the buildings

must all be repaired. I must also have spouts and drains to carry off the water clear of the yard. Until this is done, how can I have liquid-manure tanks? I should be glad of one; but you would not advise me to lay out my own money on such improvements without a lease, and my landlord will not do it for me." This is all perfectly true, and the sooner the question is settled between landlord and tenant the better. Tenant farmers are taunted by free-trade journalists and others, because they do not save their liquid manure; but until other arrangements and improvements are made, that ought to be done by the landlord, the tenant has no power to save that which he well knows is running to waste. But I fear we are running away to the question between landlord and tenant, and from the subject in hand,—viz., straw yards.

In the modern steadings a large straw yard is thought unnecessary, small enclosed yards for different descriptions of stock being preferred. These yards should be all properly paved with some hard material, and sloped gradually towards the centre—here there should be an iron grating, and beneath it a cesspool and pipes to convey the liquid manure to the tank. When these yards are bounded by stables, byres, &c., a raised foot-path should run round them, protected from the muck by a curb, so that proper roadways may everywhere exist to give facility of communication between different buildings, which is a matter of the first importance.

Straw or fold yards should always be, if possible, enclosed on the north, east, and west sides, and open towards the south; there should be no open places between buildings through which draughts might enter, and all wooden fences and gates should be made with flush-boards.

An open shed should be built in the centre of the yard, if none exist at the sides, that the stock may have shelter from the rain if they choose to avail themselves of it, which they will generally be found ready enough to do.

POULTRY HOUSE.

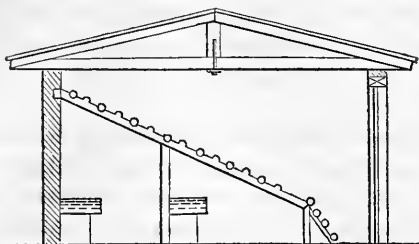
When only a few fowls are kept that have the run of the straw yards, &c., no particular accommodation is required beyond a small apartment, furnished with a few boxes for the hens to lay in.

But sometimes it is made part of the regular business, and a large stock of poultry of various kinds bred and fattened for market. In this case a proper building should be constructed, of ample dimensions, perfectly water tight, and inaccessible to foxes, cats, and other vermin. The place must be paved with stone, asphalte, or brick in cement, laid perfectly smooth. There must also be efficient drains to keep the whole dry.

The aspect of the poultry house should be either to the east or south-east, so as to receive the first of the sun's rays in the winter. In order to carry out the breeding and fattening of a large quantity of different kinds of poultry in a proper manner, it is necessary that each species should have a separate apartment to be entered by its own door. A yard should be provided into which the fowls may disperse themselves during the day. There should also be provided a proper pond for aquatic birds. The roosts for hens, turkeys, &c., may be placed over the lodgings for aquatic birds. Arrangements should be specially made for excluding the excessive heat of summer, and the intense cold of winter.

If the situation is at all exposed, it is better to have a flue, or some other arrangement, for warming the place. A small sliding trap should be placed in the bottom of each door, to allow of the ingress and egress of the birds when the doors are closed.

It is usual to place the battens at angles across the fowl houses for the fowls to roost upon; but the most efficient plan is to have a series of rough angular spars, rising one above another, from the floor to the roof, as in *Fig. 8*.

Fig. 8.—Section of Fowl House.

The nests are generally small niches or divisions placed against the wall in rows one above another. In front of each tier of nests, and level with the bottom of the nest, must be a small projecting stage about a foot in width. A step ladder must be provided for the birds to reach it. The slope of the roosting stage is usually placed at an angle of about forty-five degrees.

Pigeon Houses.—The keeping of pigeons is not at all consistent with good farming, unless it be in grazing districts, where there is no chance of damage being done to corn.

Pigeon houses are generally used as ornamental appendages to the stable yards or out-buildings attached to the residences of private gentlemen, and usually consist of a box divided into compartments about 18 inches deep, and a foot wide and high. The compartments are arranged in pairs, one being open at the front and the other closed. These boxes are generally placed on poles, which are fixed in the centre of the yards; or where a great number are kept, a regular building is erected, either standing alone or raised above the roof of some barn or stable.

It was the custom formerly to keep pigeons to a much larger extent than is now done; and the quaint little buildings we often see with high-pitched roofs standing alone, or

at a short distance from the farmery, were erected for this purpose.

The circular conical-roofed dovecot of the old French Seigneurie is always a prominent feature in the landscape of that country.

Rabbitery.—Rabbits in any quantity are seldom to be met with as a part of the live stock of the agriculturist*.

When so kept, their accommodation consists of a series of yards and sheds much the same as a piggery; but not so large.

The Apiary.—The ordinary plan of keeping bees is by placing the hives in the open air upon a stool. One leg is considered better than more, as giving greater protection from insects or vermin. The leg of the stool is driven into the ground, and upon the top of it, secured by a spike nail, is a piece of slab upon which the hive is placed. This is usually made of straw twisted and plaited; but of late years a great deal has been written about the management of bees, and a number of scientific hives invented. Some of these have glass windows for inspecting the operations of the insect, and others are divided into series of cells and arranged in stories; but the old straw hive is still a favourite with those who pay most attention to the subject.

The situation of the hive stool should always be in some sheltered corner, having fences or walls on two sides (to pro-

* Although the manure from these animals is of great value, and some farmers have found it worth while to keep them for this purpose. I see for instance, by Mr. Mechi's model of his farm, that he is keeping a quantity, and I have no doubt but he will make known the results of his experience, and his method of rearing and fattening them.

Rabbits fatted for market are placed in hutches; that is, small boxes divided into two compartments, one of which is faced with spars of wood about an inch apart, and the other is closed to the front and has an opening from the other compartment.

tect the swarm from winds, &c.), and being open to the south and west.

When there are a number of stools, they should be arranged in rows about three feet apart, those in the second row alternating with those in the first.

To protect them from being stolen, where the situation is accessible to strangers, the hive is secured to the stool by a chain and padlock.

When a large number of bees are kept in the neighbourhood of a mansion, or associated with buildings of an ornamental character, an apiary is often built.

This is a building for containing the hives, which are placed upon shelves one above another.

These little buildings are made in a variety of forms, according to the fancy of the proprietor. Bees, however, are generally considered to thrive best in the open air, as before described.



CHAPTER III.

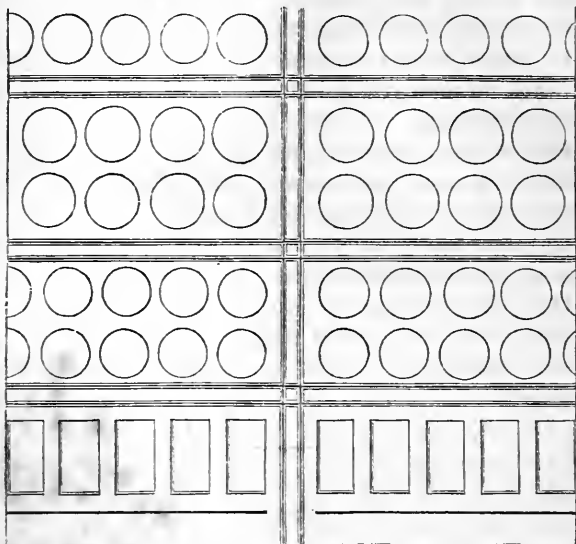
RICK YARD.

THE rick yard, as the name implies, is the place in which the various crops, grain and hay, are placed after they have been harvested.

The rick yard should be a level piece of ground, and thoroughly dry; the stacks should be placed on frames of wood or iron, called staddles. These must be arranged in such a manner that any one particular stack may be got at when it is necessary, according to the judgment of the farmer, as to whether its condition requires that it be immediately used, as in the case of its heating, or whether he requires it for consumption on the farm, or a good price may be got for it at the market.

The best plan of arranging stacks in the rick yard, is as shown in *Fig. 9.*

Fig. 9.—Plan of Rick Yard.



It will be seen by this plan, that any stack in the yard may be got at; and if a railway be laid down from the entrance to the threshing barn, the truck may be placed alongside any rick.

It is acknowledged by all, that railways should be laid down in farmeries, to facilitate the business of the farm, wherever judicious. Now, the great weight of the straw, which has to be removed to the threshing barn, renders the plan, in this case, highly advantageous. The plan of the stacks shown in the cut might be objected to, on account of its requiring a turn-table at every cross, which would occasion considerable expense; but I have been able to obviate this difficulty by constructing a particular sort of truck, especially adapted for this purpose. (For a drawing and description of this, see

Vol. II.) It is a truck so constructed as to be able to run from one line to another at right angles to it, without the aid of turn-tables.

Mr. Moreton, to get over this difficulty, and avoid turn-tables, has the line of rails leading to the threshing barn sunk below the surface of the ground, and on this a truck runs, the top of which is level with the cross lines. The truck on the cross lines, being loaded, is run on to the truck in the sunk line, and the two trucks, and their load, one on the top of the other, are run up to the threshing barn. This plan, though extremely ingenious, is for several reasons very inconvenient, and it is to obviate this inconvenience that I have designed the machine before alluded to.

THE BARNs.

The largest and most important of the various buildings forming the steading, is the threshing and store barn. In old steadings this building, from its great size and picturesque shape, is always an imposing feature; its high pitched-roof of thatch or tiles, covered with moss, and its quaint gables as seen above the trees, render it one of the most striking features in English landscape, and one which has always been a favourite with painters.

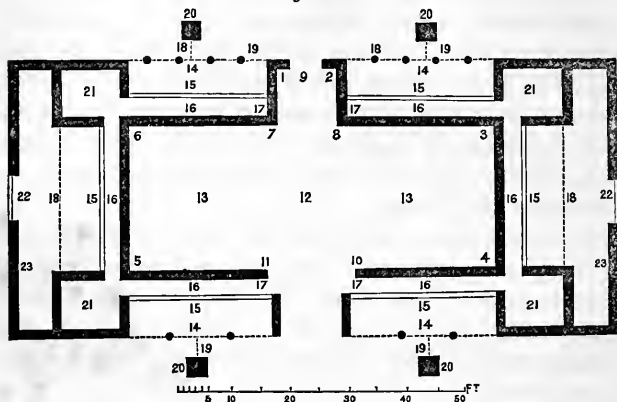
Some of these old barns, designed by early English architects, are most skilfully constructed, and often have considerable architectural pretensions. Such as the barn at Thornhill Old Hall, Yorkshire, which is a very fine specimen; and another very fine barn of brick at Old Basing, Hants, formerly attached to the fine mansion of Old Basing House, destroyed by Cromwell. There are many similar ones to be met with in almost every county in England.

These barns are generally divided transversely into three principal divisions, the centre one being the threshing floor, and the two side ones for the mows of unthreshed grain. The roof of the building is generally carried a considerable distance, eaves fashion, below the side-wall plates.

Small lodgings for stock are formed under them; and one or two small apartments in the interior, for storing the clean straw, &c.

One of the best plans of a barn of this description is shown in the annexed woodcut, and was designed for General Washington, by Arthur Young, Esq. :—

Fig. 10.



- 1, 2, 3, 4, 5, 6. The barn.
- 1, 2, 7, 8. The porch of ditto, with a small door at 9.
- 10, 11. The great door at which the carts enter.
12. The threshing floor, which extends the space of 1, 2, 10, 11.
- 13, 13. Bays in which the corn is stowed.
- 14, 14, 14, 14. Sheds for cattle and horses.
- 15, 15, 15, 15. Mangers out of which the cattle get their roots, straw, and chaff.
- 16, 16, 16, 16. Passages, between two and three feet wide, for carrying food to the cattle.
- 17, 17, 17, 17. Doors in the passage.
- 18, 18, 18, 18. Principal posts on which the shed rests.

- 19, 19, 19, 19. Gutters of brick sloped, for conveying the urine of the cattle to
- 20, 20, 20, 20. Cisterns, from which it is every day regularly thrown on the dunghill.
- 21, 21, 21, 21, are sheds for various purposes.
- 22, 22. Two yards, with each a shed for shelter, to be applied to any purpose wanted: one for sheep, surrounded with low racks; another divided for a horse or two loose, or the other half for yearling calves.
- 23, 23. Enclosure of pales.
- 1, 2, 3, 4, 5, 6, 7. The main body of the barn, which rises from 14 to 20 feet to the eaves: all the rest of the shed being placed against it.

This specimen represents the general style of ancient barns, as all of them partake more or less of its character. The ancient method of housing the whole produce of the farm in barns, and the old mode of threshing with the flail, rendered this description of barn necessary to every steading; but the introduction of the threshing machine, and other arrangements for economizing and accelerating the barn operations, render this large costly sort of barn now generally unnecessary.

Nevertheless, there are still some situations in which small barns of this description may be judiciously erected, and some crops, that in the present state of the threshing machine it is better to thresh with the flail—such as barley for malting, and to procure straw for thatching; it is therefore better to make arrangements to have a threshing floor properly situate, in the event of its being wanted.

The introduction of the thrashing machine so totally alters the working arrangements of the barn, that entirely new and different sorts of barns should be erected in all new steadings; and the great importance of threshing well, with economy and despatch, renders this building of the utmost consequence.

The most judicious situation having been chosen for the erection of the threshing barn, the next point is the application of motive power. Should this be water, this building will be dependant for details and arrangements entirely on locality; if steam, or horse-power, a fixed principle may be laid down, and in fixing this principle, it will be necessary to consider what are the operations to be performed, and the requirements for performing those operations in the best and most economical manner.

In the old manner of housing crops, it was the custom (as has been before observed), to place the whole, or nearly the whole, in large barns. The present plan, on account of much larger quantities of grain being got from the land, and the introduction of the threshing machine, has been to store the

grain crops in stacks or ricks, sometimes in the fields where the crop is grown, or a convenient place near, or else to place all the stacks in a piece of ground called a rick yard, in a convenient situation with reference to the threshing barn, and it is with this plan we have chiefly now to deal.

The first requisite of a well-arranged threshing barn should be, that the unthreshed straw be easily conveyed direct to the head of the threshing machine, and that facilities be afforded for removing the straw back (after it has passed through the machine) to the rick yard.

In a number of example steadings, there has been a great error committed in not placing the machine in such a situation that the straw may be easily and conveniently stowed away after leaving the machine. In Mr. Mechi's costly stading, at Tiptree Hall, the store barn is of enormous size; but, after the powerful threshing machine has done its work, there is no corresponding place for housing or removing the straw.

I should not, myself, in constructing a stading, erect any building for storing unthreshed straw, or housing any quantity of threshed straw; but farmers, I know, like barn room, and would be a long time before they gave up their prejudice in favour of it.

In a large stading I constructed in Hampshire, I had no place to house the crops. The waggons delivered it at once to the machine, and the straw was again removed to the rick yard. I found no inconvenience from this plan, and I would sooner be without large barns, than have to pay interest of money for them.

It is of great importance that facility be given for supplying all courts, yards, and lofts with the straw necessary for litter.

The centre portion of the building, which contains the threshing machinery, it is necessary should be constructed in a very superior manner; and it being admitted that fixed machinery is the best and most economical for all purposes, I

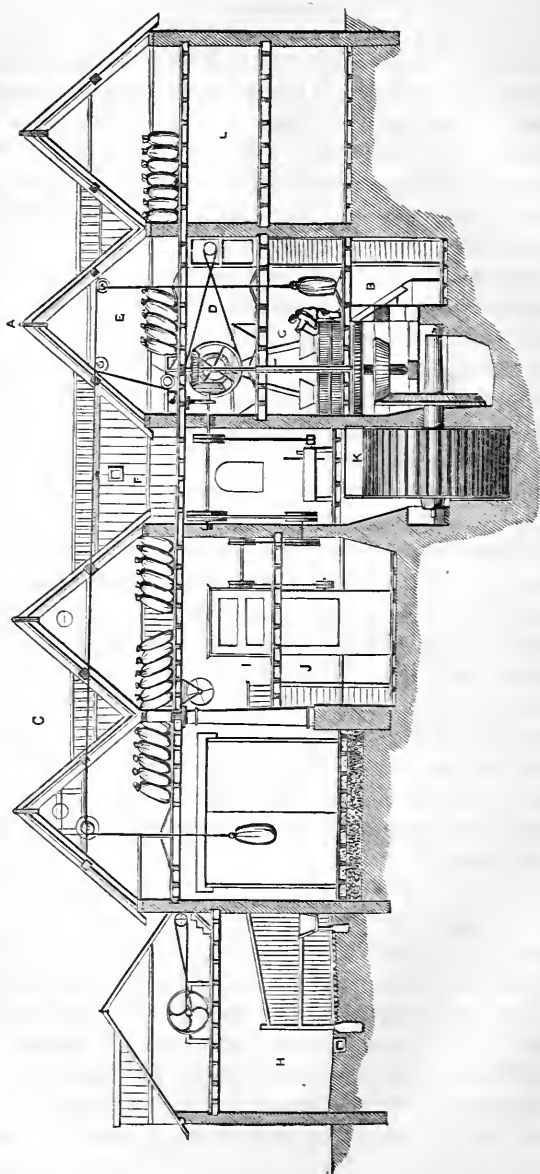
should advise that all machinery that possibly can be placed in this building, and that it be constructed and fitted up with superior materials and workmanship, and should also contain the granary and stores for everything of value, and be rendered perfectly inaccessible to vermin and thieves. For this purpose it should be divided into three floors, as in Plate 8.

A, being the pit, or lower floor, upon which are placed the winnowing machines and cleaning machinery. B, the stage floor, strongly secured and supported, upon which are placed the threshing and other machines. C, is the granary and store room. D,D, is the line of the roadway through the barn, upon which the waggons pass to deliver straw to the machine, the grain falling through to the winnowing and cleaning machines; it is then hoisted by a sack tackle to the granary above, in which are placed a series of hoppers for delivering the various materials to the machines below—such as oil-cake to be crushed; beans, oats, &c., to be bruised; corn to be ground; and wheat, when necessary, to be cleaned by passing through the smut machine. These various articles, after passing through each machine, are delivered into bins, or troughs, on the first floor, A.

Having constructed a threshing barn, granary, &c., very nearly the same as described above, upon this plan, I am able to speak from experience as to its successfully answering the purpose intended. The annexed plate represents the section through the buildings. They were constructed for and under the direction of Joseph Gibbs, Esq., an eminent civil engineer. The materials, workmanship, and fittings-up of the machinery were all of first-rate character.

A, is the corn mill, consisting of the pit floor; B, the hurst, driving gear, and meal bins; C, is the stone floor, with three pairs of stones and pastry at back; D, is the dressing floor, with dressing, bolting, and smut machines; E, is the top floor, containing the sack tackle, hopper, and shoots to the floor below; from this floor there is a covered gangway to connect

PLATE XIII.



the top floor of the threshing barn, C, with it, the whole top floor forming on one level a convenient and extensive granary and store; from this floor there is a communication to the loft, over the stables, H, in which is placed the chaff-cutting machinery. The threshing machine is placed on a stage floor, I, in the threshing barn, and beneath it the winnowing machine, the floor being sunk for that purpose.

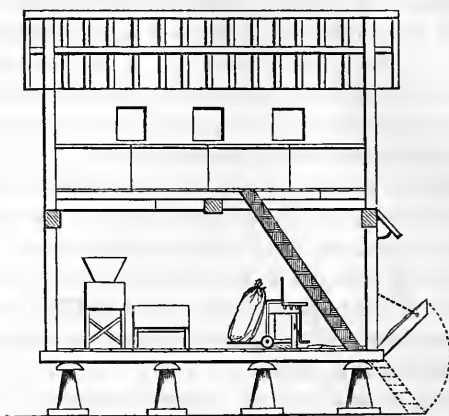
The straw is delivered at the side of the machine from the waggon, a roadway being constructed through the barn. Attached to the gear in the mill a sack tackle is fixed in the granary for the purpose of hoisting from the waggon below. In the rear of the threshing barn, and at right angles with it, is the straw barn; between the threshing barn and the corn mill is a circular saw bench.

The whole is driven by an overshot water wheel, K. L, is the dwelling house of the miller.

The ground plan of these buildings was not quite what one would have wished; the formation of the mill tail in a deep cutting and other local circumstances prevented its being otherwise. In making a new design for a threshing barn, &c., therefore I have adopted as much only of this as was found to answer well, and made my other arrangements as I could have wished, had I a clear piece of ground to build upon, and no old buildings to adapt. In the design for a large steading, Plate VI., I have still kept the same arrangements for the threshing barn and granary, the difference being in those of the straw barn.

THE GRANARY.

The most common form of granary to be met with in old farmeries is a small detached building, sometimes of brick or stone, but generally of wood; placed upon staddles, and standing isolated, in or near the farm yard. The reason for placing it thus, was to render its access as difficult as possible to vermin. *Fig. 11* represents a section of one of these descriptions of granaries on rather a larger scale than usual,

Fig. 11.—Section of Granary.

and one of the best of its kind. It was designed and constructed by Mr. Robert Burgess, at Brook Farm, Hants.

It contains two floors, with bins for grain, and a variety of other conveniences; it is also fitted with a sack tackle, scales and weights, and has a small hand corn-grinding mill and dressing machine.

The introduction of the threshing machine having considerably altered the shape and construction of the threshing barn, now renders this form of granary but ill adapted for the purpose, and I have therefore placed it over the threshing machine, and it becomes in all respects a place similar to the top floor of corn mills.

THE CHAFF HOUSE.

The advantages derived from feeding animals with cut fodder may now be considered as settled, and the chaff house to be a necessary adjunct to every steading.

This apartment should be so placed that the greatest facility be given for supplying the machine with the hay, straw, &c., to be cut, and should therefore be in such a position as to be

in direct communication with the hay and straw barn. It is also necessary that it be so placed that equal facilities be given for the supply of the chaff to all the animals on the farm consuming it.

As the chaff-cutting machine requires considerable power to drive it, and is in daily use, of course the motive power used for the threshing and other machinery is also required for this. This point must of course be properly considered in fixing the site of this apartment. A common plan in modern steadings, has been to place the chaff-cutting machine upon the stage floor of the threshing barn, and in consequence of this, the operation of cutting and preparing the chaff I have observed to be always done in an unsatisfactory manner. This has been done to avoid carrying the power (which is usually placed close to the threshing machine) to a more distant point; but as a light lay shaft, or riggers and straps, may be set up at a small cost, and very little loss of power (if within a reasonable distance), it is never worth while to have the chaff machine placed on an inconvenient site to avoid it. In the example steading at Plate VI. the chaff house is placed at the end of the bullock shed, so that the truck upon the tramway has direct communication from the chaff machine to the steaming apparatus and the feeding troughs of the animals. The walls of this room should be plastered, and a good window, with moveable sashes, so placed as to get rid as much as possible of the dust which is beaten up in cutting inferior hay.

Root Stores.—The storing of roots for stock is a matter of very great importance, and few things are more indicative of a well-managed steading than the manner in which roots are preserved. The buildings for this purpose should be exceedingly dry, and well protected from frost. They may be made of any convenient shape, and should be placed in situations the most contiguous to the places where they are required; but as the notion is now gaining ground that a railway should be laid down to connect the various divisions of the homestead with

each other, it is not so important where they are placed, so that the locality be the one best suited for the preservation of the roots. Convenient arrangements should exist for unloading the carts when they are brought from the fields. The stores should be of such a shape that the roots may not be laid in too large heaps, as they are more likely to rot when so packed, and there is the more difficulty in removing those that do not. It is very necessary that a proper ventilation should exist for root stores; a close pent-up atmosphere is the one in which decomposition takes place most rapidly.

Root-washing House.—This apartment should adjoin the cooking house, and is for the purpose of washing the various kinds of roots, previous to their being cooked for the stock. This is a point not often properly attended to, and considerable waste often occurs in consequence; a liberal supply of water should be laid on and proper troughs provided, and the necessary apparatus for washing be placed here. The various root-washing machines (of which there are several kinds) will be found fully described in Part II., on the machinery and implements of the steading. The room should be well paved, and a sink and drain provided.

Boiling House.—The advantage of feeding animals on cooked food is now beginning to be thoroughly understood, and scarcely a farm is to be found without some arrangement for effecting this object. On farms of any pretension to good management a proper building is provided, fitted with everything necessary for boiling, steaming, and even baking the food to be supplied to the animals.

It is now well known to all farmers of intelligence that the potatoe is rendered of much more value as food after being cooked, either by boiling or steaming, or what is more preferable, baking. In fact, baking is the only true way to cook potatoes, there being a bitter juice exceedingly unwholesome in the skin (and slightly in the potatoe itself), which is not got

rid of in boiling; hence the extremely bitter taste of the skin of the potatoe after it has been boiled, but after having been baked it is entirely rid of this disagreeable material, and tastes equally well with the other part of the root. Human beings cannot eat the skins of boiled potatoes, and it is no proof that animals, even hogs, like it because they eat it. For horses, potatoes should always be baked, as they are thereby rendered drier and more nutritious.

In experiments made on a large scale on the keep of coach horses, a most important saving was effected by giving the horse a large portion of the hay steamed. All inferior food or bad hay is immensely improved by cooking. An instance of this came under my notice, a short time since, at Biddulph-Hall Farm, Cheshire. The proprietor, in my presence, offered to several well-bred cows portions of heated black hay which were refused by each animal; but, after the same hay had been placed in a wooden chest, and a jet of high-pressure steam allowed to pass through it (which entirely removed all the bad odour), each animal ate it in preference to good clover-hay which was offered them at the same time uncooked.

Fuel House.—This need only be an ordinary shed, with one side open, that carts, laden with any kind of fuel, may back up to, and shoot right into it. It should of course adjoin the boiling house.

The Dung House.—It is presumed that the farmer is now fully aware of the value of ammonia as a fertilizer, and that it is the peculiar property of this valuable article to evaporate and fly off at an extremely low temperature; also, that the pungent smell in stables, by which the cattle are so much injured, and himself made uncomfortable, is caused by the evaporation of ammonia. Now, being aware of these facts, it may be supposed that he will not spare any trouble or proper expense in endeavouring to retain and econo-

mize every atom of this valuable material ; and it is also presumed that he is aware of the fact, that the brown liquid that runs from the dung heap and cattle sheds contains in solution the most valuable fertilizing elements of his manure.

He, being aware of this, will not object to the introduction of dung houses and liquid-manure tanks. The latter are indeed now to be found everywhere in modern steadings, but the necessity of a dung house has not yet become so apparent. In Scotland, they are quite common ; but in England, it is only on what are called "example farms" that they are to be met with. It is quite certain now, that farmers will have to farm higher to meet the present altered state of their affairs, and this they can only do by making more manure, and taking much more care of what they do make : for all know that upon the quantity of manure you employ will depend the quantity and quality of your crops ; and that it is impossible for farmers to farm high without it. It is therefore hoped that no apology need be made for placing the dung houses, or pits, among the offices necessary to every farm steading.

The best plan for erecting a dung house is to excavate a long piece of ground, about 6 feet in the centre, and slope to the surface at each end. It should be about 12 feet wide, and be lined and paved with brick, and coated with Roman cement at the lowest part. In using the word dung house I do not mean to recommend a covered building, but a properly constructed dépôt in which the manure shall be so circumstanced as to receive no injury from rain water. Mr. Caird says that he considers a covered dung house as the most important part of the whole steading, but equally eminent authorities entirely disagree with him. H. S. Thompson, Esq., one of the judges of the prize essays of the Royal Agricultural Society, in his review of these essays thus disposes of the question :—"The objection to covered manure pits is, the lightness of the manure, and its consequent tendency to heat itself dry with very great loss of ammonia. It certainly may be watered from a pump or tank, but this would only increase

the fermentation so long as the heap was light ; and to meet this difficulty it has been suggested that it should be frequently carted over. It is certainly possible, by carting or some other mechanical means, to give sufficient solidity to prevent mischief, but when the trouble and inconvenience of carting over a partly decomposed heap, and also the probability of its being neglected in busy seasons, are taken into account, it will probably be found that in the majority of cases covered manure pits would do more harm than good."

Manure House.—If much artificial manure be used on the farm, it will be necessary to have a separate apartment for storing, mixing, and measuring it ; it should have a hard paved floor, and be provided with scales, weights, measures, &c., &c.

Liquid-manure Tanks.—The great value of the liquid excrements of animals is now well understood, and no farmer can be found who would not like to have proper tanks for the preservation of his liquid manure. In fact, tanks for this purpose should be provided for every description of holding, from the smallest cottage to the largest farm. We have before alluded to various reasons why they are not constructed by tenant farmers, and there can be no doubt that every landlord is bound to provide them, as part of the ordinary appurtenances of the farm.

It is usual to place the liquid-manure tank in the centre of the yards ; but, as there is no good reason for so doing, I should recommend it to be placed in some convenient spot outside the general boundary of the homestead, which all the pipes from the various courts, hammels, stables, sheds, &c., may deliver to, and that the spot be chosen as conveniently accessible as possible to the farm roads.

If the dung house can be placed near it, so much the better ; but few forms of ground plan would admit of it.

Liquid-manure tanks may be constructed of any shape, but

for small farms, a round one is the best and cheapest. This will be constructed in the ordinary manner of building wells; the bricks should be set in cement, and the whole be lined with cement after.

The excavation for the tank should be made much larger than is required for the brickwork, that a good thickness of puddling may surround it, and the same under the bottom; if there be not, it will be found a very difficult matter to prevent soakage into the ground. The top of the tank should be domed over in brickwork, with a man hole left in the centre; this to be covered with a stone having a ring in it. A liquid-manure pump should be placed at the side of the tank, with the usual arrangements for filling carts, or forcing it through pipes, as is done at Mr. Huxtable's and other places.*

* Mr. Huxtable thus describes his plan. Hitherto the expense of cartage has been an effectual impediment to the application of the contents of our tanks, except to a few fields around the homestead; and therefore there has been, so far as I know, no systematic delivery of the precious fluid over all the farm. I have accomplished this, I think, both effectually and economically upon 60 acres of one of the farms which I occupy. It has been suggested that cast-iron pipes would be the cheapest and best channels of conveyance; but I am confident that they would not long resist the corrosive action of the urine at the joints: in proof, I appeal to the escape of foetid gas from the pipes in every town. I commenced with wooden pipes carefully jointed; and I am very well satisfied with them where they have been tested by an adequate pressure of fluid, and doubt not that larch and elm thus bored will be very lasting. But subsequent inquiry and experiment have led me to prefer well-burnt clay pipes of at least an inch in thickness, and properly prepared for the purpose, and capable of bearing 200-feet pressure without any symptom of moisture oozing through the pores. These pipes, of one inch and seven-eighths diameter, are sold in the adjoining parish of Twerne Minster for 7*d.* per yard. The joints, which are of a peculiar shape, are secured with cement. These pipes are placed about 2 feet underground, and at every 200 yards is inserted an upright column, bored to the same gauge as the pipes themselves. On the top of these a spout, when uncorked, will deliver the liquid; if it be not wanted there, finding no vent, it rushes onwards to the next stump, 200 yards off.

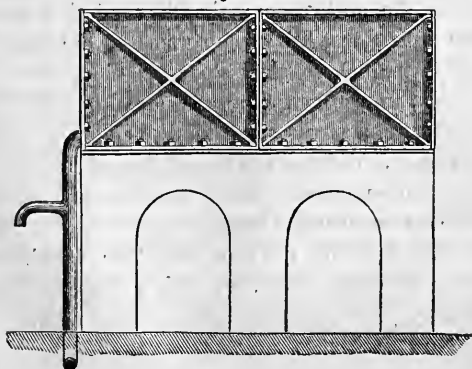
The annexed table shows the contents of various sized tanks in gallons at per foot of depth.

TABLE showing the Quantity of Excavation, the Number of Bricks required to stein the Tank, and Content in Gallons for every Foot in depth.

Diameter in the Clear.		Cubic Feet of Excavation.		1-brick Rim in Cement.	Content in Gallons between Brickwork.
Ft.	In.	Ft.	In.		
5	0	33	2	192	120
5	6	38	5	209	145
6	0	44	2	226	170
6	6	50	3	242	200
7	0	56	9	260	230
7	6	63	7	276	269
8	0	70	11	292	308
8	6	78	6	308	349
9	0	86	7	326	390
9	6	95	1	343	435
10	0	103	10	360	480

Figure 13 represents a liquid-manure tank raised on brick base, the liquid manure to be pumped into it by the steam engine, as described in page 41.

Fig. 13.



The Dairy is the place where the milk of the cows is kept, and the room in which the important process of converting that milk into butter and cheese is carried on. A very large number of farms in England are grass farms, and to most of these the dairy house, and anything in connection with it, is of the first importance, as the whole success of the farm will depend on the judicious management of it.

This task is always confided to, and exceedingly well executed by, the female portion of the household. In the constructing of dairy houses the most important points are the following:—First, That it be so placed and built that an equal temperature be preserved throughout the year; the cold of winter being equally injurious with the heat of summer. Second, That every facility be given for preserving the most fastidious cleanliness, by a plentiful supply of water and the most efficient drainage.

On farms where only a small number of cows are kept the dairy is generally a small apartment in the farm house, but on large dairy farms it is a separately constructed building, and should contain three separate apartments below, with cheese rooms above.

The dairy house should be placed, if possible, on a porous soil, and sheltered from north and east winds. The principal apartment is the milk room; the floor of this should be sunk three or four feet below the surface of the ground, and be paved with marble, polished stone, or tiles, and slope towards a drain, from which the water must run freely away; stagnant water, and smells of all kinds, being exceedingly injurious. Indeed, so delicately susceptible of injury is milk, that the smell from cheese, rennet, cooked or uncooked meat, will often cause considerable injury.

About three feet from the floor should be placed, on three sides, shelves two feet broad, of polished marble or brick, upon which are placed the pans to contain the milk.

The best material for dairy shelves is Galway marble, as it is the least absorbent. If the shelves are made of wood, it should be beech or plane tree; these woods being the hardest and most stainless. The ceilings and walls should be plastered. The windows should be covered with fly gauze, and be fitted with Venetian blinds and shutters outward. A lock-up cupboard should be conveniently placed, and the door covered with perforated wire gauze.

The Churning Room.—In this apartment is placed the machinery for converting the milk into butter. This is worked in various ways; when large, the motive power of the homestead is employed in driving it by connecting it by a lay shaft, or by bands. When the dairy house is a detached building, a horse wheel is often placed in a shed outside the churning house. The presses for squeezing the curd are placed in this room. As the temperature of the milk, in the churning room requires to be regulated, a steam pipe is introduced from the boiler in the scalding house and applied to the churn. The temperature of the milk room may be regulated in the same way.

The Scalding Room should be a roomy apartment properly fitted up with a steam boiler and copper, a rinsing tank and sink. The floor should be paved with stone or brick set in cement, and should have a good fall in every direction towards the drains. An unlimited supply of water should be provided for this. Outside the building it is as well to have a lean-to shed, with benches, upon which are placed the milk pans, tubs, and other utensils, to dry.

The Cheese Room is usually placed in the upper floor of the dairy house; it must be dry and airy, or the cheeses will dry unequally and have a spotted appearance, besides being

apt to heave. Cheeses should not be salted in this apartment, nor should wet and dry cheeses be placed together, or much injury will be the result. Shelves should be placed round the walls, and a strong wooden framing should be constructed in the centre fitted with shelves, upon which the cheeses are placed, and in such a manner that easy access may be had for the purpose of continually turning them.

Very large sums of money have occasionally been spent in the construction of dairies by various noblemen and gentlemen, but these have generally been erected as ornamental appendages to the estates, and are not such as dairy farmeries require for the mere manufacture of butter and cheese. We, therefore, need not enter into the details of such ; but should any person be inclined to construct one, he will find one of the best examples in an elaborate and beautiful dairy attached to the farm of his Royal Highness Prince Albert, in Windsor Park.

As a specimen of a first-rate dairy, we cannot do better than copy the description of the dairy at Mr. Littledale's farm at Liscard, Cheshire, from the *Farmer's Magazine* for May, 1848 :—

“The dairy adjoining is the most perfect and beautiful we have ever seen. It is a large oblong square room, elegantly and usefully fitted up. The floor is formed of Kean's patent cement, of a chocolate colour, and was laid in one piece ; but, by white lines of composition introduced, let into grooves made on the surface, it resembles fine pavement in large squares. There are two tables, one on each side, made of sycamore, with turned pillar legs of the same ; and the whole of almost snowy whiteness from washing. There is a massive marble table at the further end. Three very large octagonal shaped leaden milk coolers stand in the centre, each on an ornamental pedestal. The walls above the tables, to the height of about twenty inches, are lined with glazed Stafford-

shire tiles, resembling small squares of veined marble. There are ten square ventilators round the sides. The roof is of the pavilion or curved form, groined, with a handsome foliated centrepiece, which, being in open-work, leads the air to a large ventilator at the top of the building. The walls more exposed to the sun are built with a hollow space of three inches in them, through which a current of air passes, and there is a double ceiling, for the same obvious purpose of keeping an equal temperature in summer and winter. The milk dishes are all of glass, of various sizes, and both round and oval. These (glass being a non-conductor) are, for the preservation of the milk, and for throwing up the cream, found to be superior to vessels of the usual materials. The room is, in fine, a perfect model of a dairy in elegance, cleanliness, and adaptation. The milk kits, or pails in which the milk is brought from the shippens, are all beautifully made of sycamore, and are kept so clean that the wood, like the tables, is white and spotless, and the iron hoops of dazzling brightness."

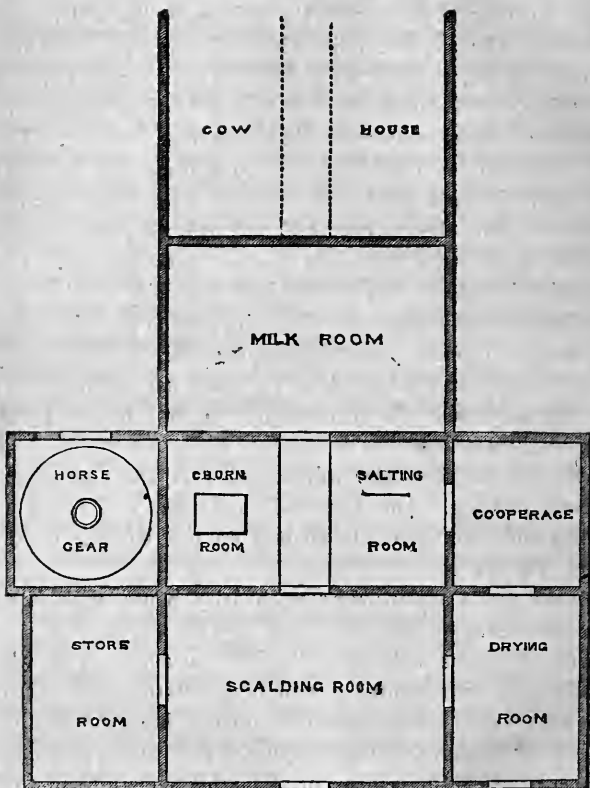
The plan of this dairy will be found in the plan of the Liscard Steading. For the utensils and manner of fitting up presses and churns, see the chapter on the Utensils of the Dairy, Part II.

PLATE 14 is a plan of a Dutch dairy house, with horse gear attached.

The milk-room walls in Holland are usually covered with small square tiles, white, or with blue pattern. The shelves are of hard grey stone of excellent quality, brought down the Rhine for that particular purpose. The floor is of hard clinker bricks set in cement, or of marble something like the shelves. The process of butter and cheese making in Holland is carried on with great care and skill.

Wool Room.—On large farms where many sheep are kept,

PLATE 14.
Dutch Dairy House.



it is necessary to have an apartment provided for this purpose, the storing and packing of wool being an operation of considerable consequence.

The floor of the wool room should be planed clean, and be of hard wood, the floor boards ploughed and tongued. The walls and ceiling should be properly plastered with hair plaster. It is usual to have three strong beams extending from wall to wall below the plaster of the ceiling, for several purposes. In these are placed strong iron hooks; two of these support the pack line used in packing the wool into canvas bags called packs, and the other is for supporting the beam of the scales during the operation of weighing the fleeces and packs.

A window should be provided with moveable sashes and a shutter, for partially or perfectly excluding the light when necessary. The door should be made large enough to allow of the exit of the wool-packs; six feet in height, and four feet in width, is sufficient. A small closet in one corner with shelves is also necessary, having a proper lock and key for its door.

Shepherd's Store.—A small apartment in which the shepherd keeps the various articles used by him, such as medicines, tar, ruddle, &c. This building should be arranged, (if possible,) to communicate directly with the sheep shed.

Engine House.—A small separate room should always be appropriated for the steam engine, wherever one is used. It should be properly constructed of brick or stone, paved and plastered; it should have well-fitted windows, and the door should have a good lock and key—the latter being always kept by the foreman when the engine is not in use, so that labourers or other persons who have no business there may be effectually excluded, and tampering or playing with the ma-

chine prevented. I know from experience this to be a very necessary precaution.

For the manner of fitting up the engine, shaftings, &c., in the room, see the article on Steam Engines, Part II.

Smith's and Carpenter's Shop.—On very large steadings it is found to be of great advantage to have constructed on the premises a smith's forge, and a wheelwright's or carpenter's shop. They are to be found on many large farms, and always in use. The great loss of time and heavy expense in shoeing horses and doing the smith's work of the farm elsewhere, fully justifying their erection. Something is always giving way or wearing out; and with renewings and mendings the smith need seldom be unemployed. The wheelwright's shop should adjoin the smith's by a covered shed, under which horses can stand to be shod, &c.

The wheelwright should do all the carpenter's work on the farm, keeping all the buildings, as well as carts, waggons, and agricultural implements, in proper repair, and painting them at proper times. He should also be hammerman, and strike to the farrier or smith. Should any leisure time occur, the two can have a new waggon or cart in the course of construction. On large farms, and with judicious management, there is no doubt that the resident wheelwright and smith will save a great deal of time and money to the farmer.

The smith's shop should be not less than fifteen feet square, built of brick or stone, roofed with slate or tiles, and have a floor composed of smith's ashes, and clay, or chalk; there should be a good window on one side, and a door in halves.

Implement House.—In the old method of carrying out agricultural operations, very few implements, and those but of little value, were used. Half-a-dozen clumsy wooden ploughs, two wooden rollers, with one or two sets of clumsy harrows,

constituted the entire stock. The roller spent nine months of its time exposed to all weathers, at the corner of the field where last used, or in a green lane adjoining the land. The harrow, if much cared for, was reared up under the dripping eaves of some building; and as for the ploughs, they never left the field.

This being the farmer's practice, it may be imagined no implement house was thought necessary, and in the old steadings none is ever to be found. To be sure, a small place was sometimes contrived, by carrying the eaves of some low building, generally the cart lodge, within a foot or two of the ground, into which hole a few things were occasionally crammed. No new steading can be considered complete, unless a properly constructed apartment be provided for all agricultural implements and tools, as the dead capital in implements, and cost of keeping them in repair, is now a very important item in farm accounts; and at every agricultural show may be observed new implements, of beautiful and scientific construction, for economizing and accelerating farm operations; and in nine cases out of ten, the effectiveness of these implements would be negatived if the working parts were neglected, and no encouragement is given to the implement maker to improve his machines by superior materials, if knowing it would be all thrown away by the rough usage they are afterwards subjected to.

The implement house should be large enough to contain all the implements of the farm; it should be thoroughly wind and water tight, and have a hard paved floor. The walls and ceiling would be the better for being plastered, and should be whitewashed once a year. Shelves should be provided for placing all the moveable parts of the implements, wood and iron tacks for hanging up others; a large closet, with a window in it, should be also provided, in which the foreman would keep all extra gearing, such as plough-shares, tines, ducks' feet, chaff knives, ropes, tackles, small tools,

and other articles. Over head a loft should be provided, for placing the ladders, poles, sheep troughs and cages, and other things requiring length in the berth.

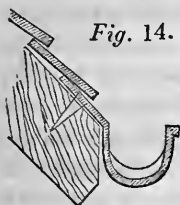
In the "Royal Agricultural Society's Journal" will be found some judicious advice on the care of implements, by Mr. Crosskill, from which we extract the following. "When the ploughs are done with, let them be washed and put in their proper places; let the same be done with the drill, and so on with all the machines on the farm. The cost of this will be trifling, compared with the advantage. In order to effect it, select the most likely agricultural labourer upon the farm; put the implements under his care; make it a strict rule with all the men that such implements done with for the season shall be brought to one particular place, say near the pond or pump; the man having charge of the implements must then wash and clean them well before putting them into the shed, and at a convenient time, when not otherwise engaged, or in weather when out-door work cannot be performed, get them repaired and paint them. At the end of this shed, or implement house, there might be a lock-up workshop, with the door to open into the place, with a few tools, paint pots, &c., the expense of which would not exceed 5*l*. The man should be encouraged to make his duty a pleasure, and to feel a pride in showing his master's implements in fine order."

Cart Lodge.—Any ordinary cheaply constructed shed will suffice for sheltering carts, &c. It may be a lean-to against some other building; but it should always be enclosed on three sides, and be dry and thoroughly water tight. If doors are added it will be all the better.

Drainage.—This is a most important point to be attended to, and one of those generally neglected. The eaves of buildings in and about the steading must be provided with gutters and spouts which empty themselves into drains, so as to

carry off, clear of all yards and courts, every drop of rain water that falls from the immense surface of roofing that must necessarily exist in all farm steadings. The drains must be so arranged that none of the rain water can get into the liquid manure tanks, as, from the neglect of this precaution, a great deal of money is wasted by farmers in carrying to their land discoloured rain water under the impression that it is liquid manure.

Of the various kinds of gutters used for farm buildings, I am inclined to give the preference to the plan of making the last eaves-tile of the gutter thus :—



This plan was exhibited in different sorts of tiles and slates at the Great Exhibition, with a continual stream of water constantly running over the roof, and away by the gutter so formed. It appeared to answer well; the difficulty would, of course, be in keeping the joints water tight, and arranging for the fall, when the building is of great length. This is done by making the tiles thicker at one end than the other. There are such a variety of cheap gutters made now of zinc, iron, and other materials, that the expense cannot for a moment interfere with the advantage to be gained. Stack pipes must be placed in proper situations to carry off the water to the proper receptacle.

Drinking Ponds for the stock, should be placed in a convenient situation, and be a properly formed work. The shape of the pond is by some preferred circular; but, I think, if it has a well-formed bottom of hard stones, and side walls of brick or masonry, a parallelogram will be the best shape; deepening towards the centre—the extreme depth should not be more than to cover the horses' knees. Horses on no account should be allowed to wet their bellies, although the men are very fond of splashing them about in deep water, the

true cause of which is to save their own labour in cleaning the animal. A considerable thickness of good clay should be laid under the pond, and as a backing to the side walls.

A good tank should be placed at such a height as to supply the drinking-troughs in different parts of the steading.

It is of the first importance that the ground about, as well as that upon which the steading stands, be thoroughly dry. This is best effected by its being well tile-drained at a considerable depth; a line of ordinary field pipe tiles should also be laid by the side of the footrings of all foundations around the whole of the buildings, the expense of which is very trifling, compared with the advantages of the dryness that will follow.

FARMER'S RESIDENCE.

In discussing the question of farmers' residences, it will be necessary to consider the dwelling as one strictly suitable to a person who gets his living from the cultivation of the soil, and proportioned to the size of the holding, the capital employed, and the position in society that he has a right to assume, from the possession and application of that capital.

I hear it very commonly remarked now, by persons who do not know much about the matter (and, therefore, do not sympathize with the farmer in his present position), that he is much too well lodged, and that, instead of a farm-house, he occupies a mansion. The simple style of his forefathers is abandoned, and the old-fashioned house place is not now good enough; but elegant drawing-rooms, boudoirs, and conservatories, are necessary to the comfort of the farmer and his family. They also complain that he keeps his hunter and a couple of dogs, and has a double-barrelled gun, *not made at Birmingham*.

These remarks can only be made by persons who are entirely ignorant of the amount of capital necessary to carry on the agricultural operations of rearing and feeding stock, and

the cultivation of the soil, in a proper and efficient manner. A person carrying on any ordinary business in town or city, employing the same amount of capital, would live in precisely the same manner, and occupy a station in society in proportion to his character and wealth, exactly as is done by the agriculturist in the country. It is, therefore, necessary, in considering the size and accommodation of his dwelling, to proportion it strictly to the amount of land occupied, it being presumed that the proper amount of capital per acre is embarked in it, and that *the agriculturist and his family have the same right to the luxuries and refinements of life as another person who has embarked the same amount of capital in spinning cotton, or printing calico.*

The construction of the farmer's residence, therefore, becomes a matter for him and the architect to consider and arrange between them, according to their own fancy; and not being in any way connected with the working part of the steading (except in very small farms, such as plate 15), I do not think it necessary, in a book of this limited size, to enter at all into its construction, as, in modern steadings, it is well removed from the yards and sheds, and is not necessarily near them. That I am right in this view of the case is proved, I think, by the designs, sent to the Royal Agricultural Society, not having any residences attached, except for the herdsman and housekeeper.

Kilns.—Kilns used in connexion with agriculture are of various kinds—for burning, as for lime, tiles, and bricks, and for drying, as for hops, and oats, and for malting barley.

Lime is the protoxide of calcium, formerly thought to be a simple substance, but now ascertained to be a compound of oxygen and a metallic base. It is powerfully caustic, and has properties intermediate between those of an earth and an alkali. It is found in combination with a variety of

of acids—with sulphuric acid in gypsum, and with carbonic acid in silicious, magnesian, and common limestone. In chalk and marl, and in some of their combinations, it becomes an important constituent of the earth's crust. It does not naturally occur in an uncombined state, and whenever it is wanted by itself it must be separated from some one of its natural compounds; and for agricultural purposes, this is generally done by calcination in a kiln.

These kilns are constructed in a variety of ways according to the extent of the work to be carried on, and the manner of burning.

The simplest, and that generally used by agriculturists, is a draw kiln, constructed in the side of a hill, to avoid as much as possible the expense of brickwork or masonry. An excavation is made in the shape of an inverted cone (or formed in the solid brickwork), and lined with fire-brick, or the best kind the locality produces. These kilns may be made of any size—an ordinary one is about ten feet diameter at the top, and tapering down to about six at the draught-hole, as in *fig. 15*.

SECTION OF DRAW KILN.

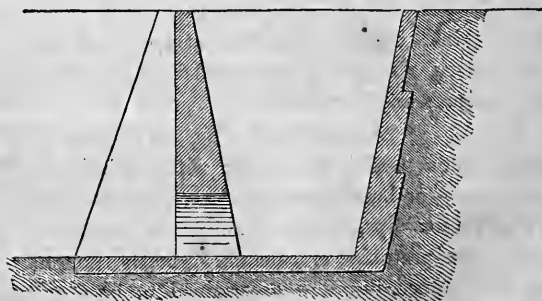


Fig. 15.

The depth for that diameter should be not less than ten feet. Two iron bearing bars are laid across to support the

fire-bars, which are placed about an inch apart, and should be about an inch and a quarter square, with length for sufficient bearing into the solid brickwork. When the kiln is first started a large fire is made upon these bars, and upon it pieces of limestone are placed; and when they are well heated another layer of coals is added, and then more chalk, and so on to the top of the kiln—the quantity of fuel being regulated by the kind of material to be burnt, and which is soon found in practice. The kiln being kept properly alive will continue burning for any length of time without rekindling, the limestone and fuel being supplied at top as it is removed from the eye.

It is usual to draw once in twenty-four hours, which is done by removing the fire-bars, and drawing as much lime through the eye as the experienced lime burner knows to be thoroughly calcined. The bars are then replaced as before.

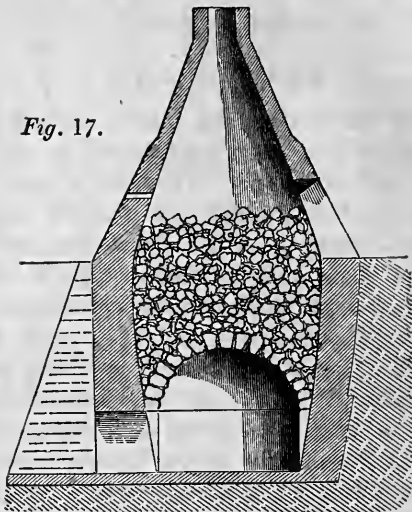
There are a great variety of kilns made upon this principle, but varied according to the amount of business to be done, and the material to be converted into lime. When very large they have two or three eyes to the kiln, and a vaulted passage is made round the back of it to allow of the lime being drawn.

In those counties where copse-wood, furze, or fir bavons are plentiful, they are used as fuel for burning lime, tiles, &c., and when this is the case, a different arrangement is adopted, called a flare kiln.

In this plan all the kilns have a regular head or roof, and the firing takes place at the bottom, and is continued till the whole kiln of limestone is calcined. The fire is then suffered to go out, and the lime is removed; a new quantity of stone is placed in the kiln, and the firing again takes place.

Fig. 17 is a section of a flare kiln, such as are in common use in North Hants, and in Surrey, in the neighbourhood of Farnham, where most extensive manufactures of red pottery are carried on, which, as well as lime and bricks, are burnt in this manner.

SECTION OF FLARE KILN.

Fig. 17.

In preparing a kiln of this kind for firing, it is necessary to construct an arch of the materials to be burnt; of bricks, if for bricks, and of the large blocks of chalk or stone, if for lime. To facilitate the construction of this arch, a bench is built all round the kiln about four feet from the floor from which the arch springs. In small kilns for lime, only one arch is turned, but in large ones a pier is constructed through the centre, and a double arch is built. The largest and best-shaped lumps being selected for the purpose, on the top of these are placed the smaller pieces, as in *Fig. 17*.

The fuel is placed under the arches, and a large body of flame kept up, which finds its way through the interstices of the lime. The flame is increased towards the end of the burning; and at last the driest and best fuel is added, and the whole mass raised to a white heat, by which the whole of the carbonic acid is expelled, and the chalk or other material converted into lime.

CHAPTER IV.

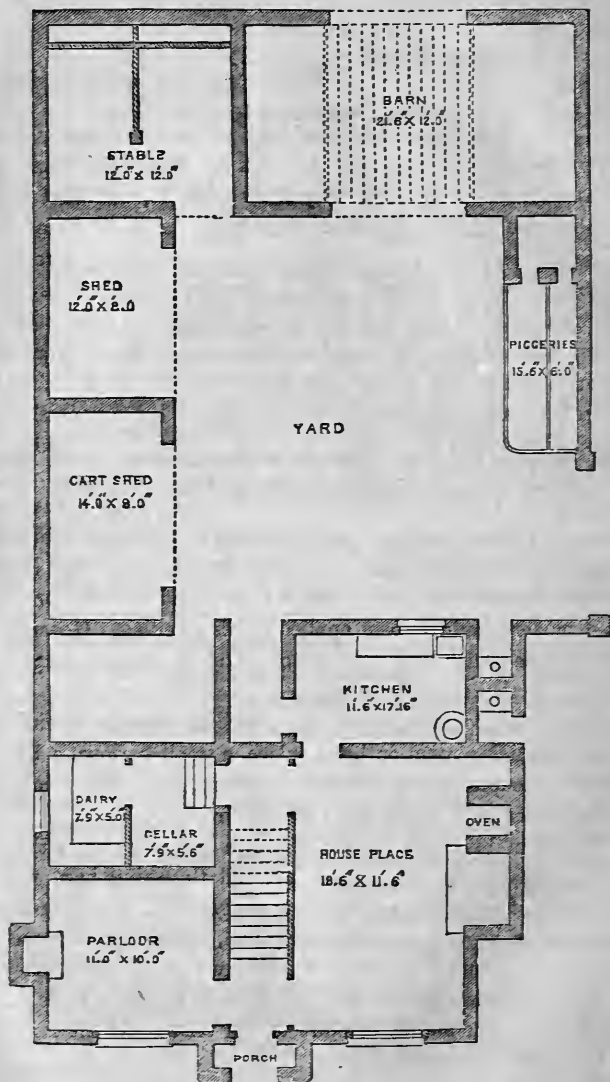
SMALL FARMS.

THE smallest size steading that can be required is that of a farm of about forty or fifty acres (that is, one that will employ one pair of horses). There are a great many of these to be found in England, and generally they are exceedingly well managed, as the farmer himself does the principal part of the work, and takes a part in everything. These little farmers are sadly in need of assistance; for the accommodation for themselves and their stock is of the poorest possible description, the farm-house being generally a larger description of cottage, and the agricultural buildings only one or two sheds. Not having the advantage of valuable implements for economizing labour, it is especially necessary that he should have all the advantages of convenient buildings. I never remember to have seen one of these little yeoman farmers who had a tank for his liquid manure, or the least modern improvement applied to his dwelling. Generally too humble to ask it of his landlord, and of too little importance to be thought of without.

The accommodation consists of dwelling-house, containing a general living room or house place, a small parlour, a back kitchen, adapted for a scullery, brewery, &c., and a small dairy and cellar. Above are three bed rooms.

The farm buildings consist of a cow byre for two or three cows, a stable for two horses, a small threshing barn with threshing floor and two bays, a piggery for breeding-sow and fattening hogs, a shed for cart, fuel, and other purposes, a straw yard with liquid-manure tank, with drain from privy, cow byre, stables, house, &c. The whole is designed to economize labour, and supply comfort to the tenant and his family at the smallest possible cost.

PLATE 15.



GROUND PLAN OF SMALL STEADING.

Fig. 18.



ELEVATION.

ESTIMATE FOR SMALL STEADING,

Consisting of Dwelling-house of Six Rooms, Barn, Stable, Cow Byre, Piggeries, Manure Tank, and Drains to ditto.

	£	s.	d.
25 yards cube of excavation	—	—	—
7½ rods of reduced brickwork	—	—	—
63 yards superficial of brick flat paving	—	—	—
16¾ squares of Countess slating	—	—	—
166 yards superficial of render set to walls of house	—	—	—
90 yards superficial of lath, plaster, and set ceilings	—	—	—
330 feet cube fir joists, rafters, wall plate, &c.	—	—	—
29 ft. 6 in. cube wrought, and rebated door and window frames	—	—	—
113 feet cube fir framing to barn	—	—	—
13 ft. 9 in. cube oak wrought posts and sills	—	—	—
1 square superficial oak threshing floor to barn	—	—	—
5 square superficial inch folding floor in dwelling-house	—	—	—
17 square superficial slate battens	—	—	—
4½ square superficial ¾ weather boarding to barn	—	—	—
40 feet superficial 1½-inch wrought and rebated jamb linings,	—	—	—
35 feet superficial 1½-inch wrought partition to stalls	—	—	—
142 ft. 6 in. superficial inch proper ledged doors	—	—	—
230 feet superficial 1½-inch braced doors to barn	—	—	—

Carried forward

	£	s.	d.
Brought forward			
32 feet superficial inch ledged shutters	—	—	—
73 ft. 6 in. superficial inch treads and rises to stairs .	—	—	—
50 feet superficial inch cupboard front, with 4-panel door to ditto, complete	—	—	—
28 feet superficial inch wrought top and shelves to do. .	—	—	—
15 feet superficial inch wrought seat and riser to privies,			
	—	—	—
30 feet superficial $\frac{1}{2}$ -inch wrought window linings .	—	—	—
122 feet superficial $\frac{3}{4}$ square skirting	—	—	—
12 feet run $1\frac{1}{2}$ -inch manger and oak curb	—	—	—
11 ft. 3 in. superficial inch chimney shelf	—	—	—
6 feet superficial 2-inch chimney shelf	—	—	—
5 feet run handrail with newel bar and ballusters . .	—	—	—
39 feet superficial hearth and back hearths	—	—	—
38 ft. 10 in. superficial $1\frac{1}{2}$ mantle and jambs. . . .	—	—	—
4 ft. 10 in. cube stone sills to doors and windows . .	—	—	—
10 feet cube stone plinths	—	—	—
10 ft. 6 in. superficial $2\frac{1}{2}$ -inch York step,	—	—	—
4 feet superficial York stone sink	—	—	—
118 yards superficial painting in 3 oils	—	—	—
40 yards superficial painting in 4 oils	—	—	—
28 feet superficial iron casements glazed	—	—	—
2 cwt. of wrought ironwork, for general purposes . .	—	—	—
65 feet run of 3-inch cast-iron guttering	—	—	—
24 feet run of 2-inch rain water pipe	—	—	—
2 heads, at 1s. 10d., 2 shoes	—	—	—
30 wrought iron brackets and nails to ditto	—	—	—
No. 10 pair of 18-inch \times garnet hinges, at 1s. 2d., 9 Norfolk thumb-latches, at 7d., 4 9-inch barrel bolts, at 9d., 4 6-inch iron rimmed locks, at 2s. 6d., 4 wrought-iron bars to windows	—	—	—
4 pair of strong hooks and bands to stable and cowhouse, at 2s., and 2 pairs of ditto to yard gates	—	—	—
No. 1 2-inch cast-iron pump fixed to tank	—	—	—
5 feet of $1\frac{1}{2}$ -inch lead supply pipe to ditto	—	—	—
5 feet of 2-inch lead waste pipe to sink	—	—	—

£207 0 11 $\frac{3}{4}$

Total cost of building, fitting, and finishing ready for occupation, exclusive of builder's profit of the above, amounts to 207*l.* 0*s.* 11½*d.*

Farm Labourers' Cottages.—Scarcely any subject has had more attention bestowed upon it (by all sorts of persons, architects, landscape gardeners, philanthropic individuals, and others) than the social condition of labourers, and the external appearance and internal accommodation of their cottages. Nine-tenths of the books, both illustration and letter-press, are utterly useless for any practical purpose. The larger works are all devoted to designs of a strictly ornamental character for model cottages for labourers, bailiff, &c., and of every conceivable design, imported from every country of every climate in the world; these are chiefly meant to add beauty to the landscape immediately adjoining some nobleman's mansion: they were thought very fine in their day; but the true Christian principle of constructing a house adapted to an English climate being now properly understood, these absurdities merely exhibit their handsomely bound backs in the library, or lie as heavy weights on the shelves of the bookseller's shop. Labourers' cottages, such as the practical farmer has to do with, must be looked at as positively necessary to an estate, and of an useful character, so that we must consider what accommodation labourers can do with comfortably, and what he can afford to pay, and give him the most we possibly can for his money.

The rent of agricultural labourers' cottages varies in different places from one shilling per week, upwards, with a small garden only. Half-a-crown per week is as much as labourers can be expected to pay for a comfortable cottage and small garden, and this should consist of a house place, back wash-house, and two bedrooms over. An oven and copper should be provided, with a privy and hog-stye; for though I do not think much of what cottagers gain by their

hogs, yet I think it is a sort of savings-bank, where something is being constantly put by that would be wasted or spent at the nearest beer-house.* It is quite certain that the designs for labourers' cottages usually made by architects, cannot possibly pay any fair interest for the outlay. It is clear, then, that as the labourer can only afford at most five pounds per annum, and that he must have the accommodation we have described to live decently, every means must be tried to lessen the cost of constructing his dwelling; and the principal points to be kept in view are, to avoid all breaks in the walls as much as possible, and to make everything work square, in order to get the whole under one roof without breaks. It is a common practice with the modern architect to design cottages with immense projecting eaves, to have the roofs lapping over one another, which must be the case if lean-tos and smaller gables are placed against the walls, and a large one over. This is roofing the same area twice over, and, of course, is an unnecessary expense. The roof should have no more pitch given to it than is necessary to carry off the water and the snow properly. The plan adopted now of constructing roofs of an enormous height is bad; in fact, some architects make the whole cottage out of a roof, bringing the eaves of some parts down to within a few inches of the ground, and this they conceive to be the picturesque early English style, of which it is, in reality, only a caricature.

Doubtless, cottages and other buildings constructed upon the plan of the early English architects, will last longer than any other; and be the most comfortable to live in, and the most pleasing to look at.

I perfectly agree that it is so, but they are by far the most costly; and I must say, as I have before said, that with wheat at 36s. they are not to be thought of by those whose

* Some farmers object to their labourers keeping hogs, and instead supply them from their own styes with a fat hog at the price it stands on their books, the labourers paying a small sum weekly for it,

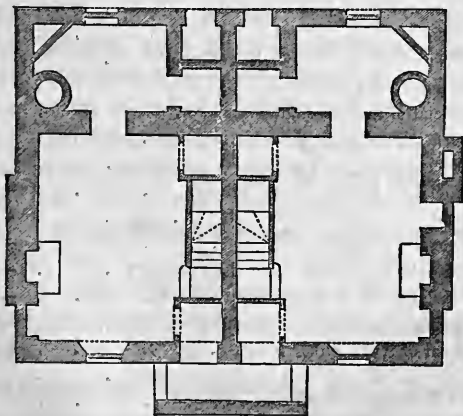
necessities require them to receive a small per-centage on their outlay even for housing their labourers.

The annexed design is for a double cottage for ordinary farm labourers, and estimated to be erected and finished ready for habitation, for 95*l.* each cottage :—

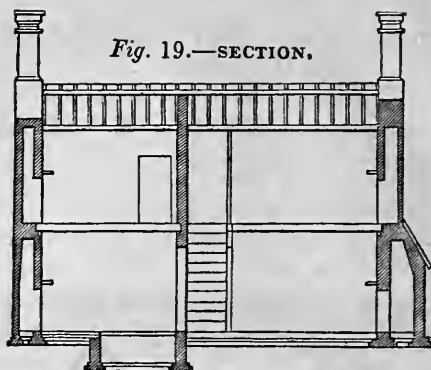
PLATE 16.



ELEVATION.



PLAN.



Cost of Building a Farm Labourer's double Cottage.

	£	s.	d.
20 yards cube of excavation to foundation	—	—	—
8 rods superficial of reduced brickwork	—	—	—
16½ square superficial of Countess slating	—	—	—
200 ft. cube of fir joists, rafters, plates, &c.	—	—	—
27 ft. 6 in. cube of fir wrought door and window frames	—	—	—
4½ square superficial of inch folding floor	—	—	—
16½ square superficial of ¾-slate battena	—	—	—
280 ft. superficial of 1½-inch framed partitions	—	—	—
336 ft. superficial of inch proper ledged doors	—	—	—
112 ft. superficial of 1½-framed and ledged doors	—	—	—
32 ft. superficial of inch seat and riser	—	—	—
126 ft. superficial of inch square skirting	—	—	—
24 ft. superficial of 1½ jamb linings	—	—	—
46 ft. superficial of ½-inch window linings	—	—	—
27 ft. superficial of inch chimney shelf	—	—	—
28 ft. superficial of inch shelves	—	—	—
54 ft. superficial of inch treads and rises to stairs	—	—	—
36 ft. superficial of 2½-inch York step	—	—	—
37 ft. 6 in. superficial of 1½-hearths and back hearths,	—	—	—
8 ft. superficial of York sink	—	—	—
26 ft. 3 in. superficial of ½-inch mantle and jambs	—	—	—
32 ft. run of York window sill	—	—	—
85 yards superficial of brick flat paving	—	—	—
287 yards superficial of lath plaster, and set	—	—	—

Carried forward

	£	s.	d.
290 yards superficial of render set	—	—	—
100 ft. run of compo labels outside	—	—	—
Cesspool to privies	—	—	—
Rain-water tank, 300 gallons	—	—	—
1 2-inch cast-iron pump	—	—	—
5 ft. run of 1½-inch lead pipe	—	—	—
5 ft. run of 2-inch waste to sink	—	—	—
230 yards superficial painting in 3 oils	—	—	—
No. 2 heads, 6d.; 2 shoes, 6d.	—	—	—
75 ft. run of 3-inch cast-iron eaves gutter	—	—	—
26 ft. run of 2-inch rain-water pipe	—	—	—
No. 2 heads, 1s. 10d.; 2 shoes, 1s.	—	—	—
No. 30 brackets and nails	—	—	—
Labour fixing ditto	—	—	—
No. 22 Norfolk thumb latches, 7d.; 4 7-inch iron-rimmed locks, 2s. 6d.; 22 pair of 18-inch X garnett hinges, 1s. 2d.;			
4 9-inch barrel bolts, 9d.	—	—	—
80 ft. superficial cast-iron casements glazed	—	—	—
Exclusive of Builder's profit	£189	0	0

SPARRED FLOORS.

Sparred Floors for Cattle Sheds are among the more modern improvements introduced in the construction of farm steadings; it is having the joists of the floor of the feeding houses covered with spars or laths, instead of boards. Mr. Huxtable, of Sutton Walden, has the credit of having introduced this plan, but it is by no means new, having been used in Gloucestershire for many years, for flooring the calf pens and feeding sheds, as the following extract from a survey of Gloucestershire will prove:—

“It is observed by Marshall, that all the calf pens in Gloucestershire are of a durable construction, extremely simple, but singularly well adapted to the object. The house or rooms each measure 12 feet by 8: 4 feet of its width are occupied by the stage, and 1 foot by a trough, placed on its front, leaving three feet as a gangway, into the middle of

which the door opens. The floor of the stage is formed of laths about 2 inches square, lying the longway of the stage, and 1 inch asunder; the height of the floor of the stage from the floor of the room is about 2 feet."

I cannot do better in describing this method of flooring, than by quoting Mr. Mechi's own description from a paper read by him to the Society of Arts Nov. 27, 1850, on British Agriculture. He says:—"Having practised the system rather extensively, I will communicate to you the details; observing, that although attended, as every system must be, with certain disadvantages, the balance of benefit is sufficiently considerable to induce me to continue and extend it. The quantity of stock I have now on boards is 100 lambs, 60 calves, 10 cows, 50 sheep, 30 bullocks, 200 pigs. We are indebted to the worthy and Rev. A. Huxtable for the idea; but I found a space of $\frac{3}{4}$ of an inch between the planks insufficient; I therefore measured the hoofs of the various animals, and arranged my openings accordingly. Thus,

	Inches thick.	Do. wide.	Do. space.
For Bullocks . . .	3	4	$1\frac{7}{8}$
For Sheep . . .	$1\frac{1}{2}$	3	$1\frac{1}{4}$
For Pigs . . .	$1\frac{1}{2}$	3	$1\frac{1}{4}$
For small Pigs and Lambs . . .	$1\frac{1}{2}$	3	1
For Calves . . .	2	3	$1\frac{5}{8}$

For large Cotswold or Kent sheep, $1\frac{3}{8}$ opening would not be too large; $1\frac{1}{4}$ openings do well for Hampshire Down lambs, but are rather too large for small Sussex Downs.

"One cannot too highly appreciate the system on heavy lands where the animals cannot be profitably folded during winter. The area allowed for each animal, and its feeding apparatus, is thus:—

	Sup. feet.		Sup. feet.
Small sheep . . .	8	Small bullocks . .	30 to 40
Large sheep . . .	10	Large bullocks . .	50 to 60
Small pigs . . .	6 to 8	Large pigs . . .	9 to 11

“Very much depends on the season and weather. In cold weather pigs and bullocks can scarcely be packed too close, so long as there is room for them to lie down comfortably. Sheep require a little more room, or ventilation. In fact, it requires a nice observation to adjust the ventilation and temperature. This is best done by a thermometer, because our own feelings are not always a sufficient criterion. Every cattle shed should feel as comfortably warm as a drawing-room. The opening for ventilation should be at the highest point. I should say that the bars or planks may be either of straight-grained yellow deal, or straight-grained hard woods: the latter are to be preferred for heavy animals, as they wear off the edges of the deals. The depth of the pits may be from two to four feet. It is necessary, once in a way, to level the manure to prevent it touching the boards: it would soften them, and cause them to break. I should say that we never sweep the floor, but the animals are perfectly clean. Of course the manure is taken at once from under the boards to the fields, without the interventional expense of a double carting, shooting, or turning over a dung heap. The effect on the crops is unmistakable.

“In order to pay you 10 per cent. on your investment for the whole building and floor complete with troughing, &c., you would charge your bullocks $1\frac{1}{2}d.$ per week; sheep and pigs, $\frac{1}{4}d.$ per week. The cost of erecting covered homestalls complete, with boarded floors, will not exceed 1s. to 1s. 3d. per superficial foot.

“One man on my farm feeds, and entirely attends to, 250 pigs. It would require two men on the old straw-bed system. Our pigs are never cramped now; formerly they used to be, owing to the manure heating under them, and the cold air giving those parts rheumatism. I must confess that I never like the look of my animals so well on them, as I do on a little mountain of clean straw, or a nice green pasture; but this is not a question of fancy, but profit, and I am quite sure

the system is quite advantageous. It is true we like a soft bed, and so do the animals, but our medical advisers recommend a hard one.

“ There is a very powerful development of the muscles on boards, so much so that with fattening pigs not bred on the boards, I have found some of them get capped hocks. It is surprising how quickly you may fatten *young* pigs on these floors. They find it inconvenient to run about, and so divide their time between eating and sleeping, a most agreeable operation for the account book.

“ Another question connected with the boarded system, is the fly question. Where you have plenty of food, warmth, and stock, you will have abundance of flies. My bullocks could never lie down in the day time, owing to their attacks, and of course the continued lifting of their feet prevented fattening. By darkening the feeding houses, I entirely removed this nuisance, and had the gratification of putting my animals into a most profitable state of repose ; for if you have ten millions of flies, not one will bite in the dark. I find that some of my friends, who value the condition of their horses, have long practised this system. It is essential to the successful house feeding of bullocks with green crops during summer. Sheep are never struck by the fly on boards, and do not seem to be much annoyed by them.”

Now I have myself seen cattle houses floored in this way, several times, both at Mr. Mechi's farm and elsewhere, and cannot say that I was at all impressed in its favour by appearances. The cattle looked extremely uncomfortable, especially when, as I once saw them at Mr. Mechi's, the floor was also strewed over with lumps of burnt clay. I have consulted several farmers of great skill and sound judgment as to the merits of this plan, and generally found an opinion expressed *unfavorable to it*.

Objections to it have been well and humanely urged by the Rev. George Wilkins in a letter to the *Agricultural Gazette*

of December 4, 1847. The reverend gentleman, in speaking of a plan somewhat analogous to Mr. Mechi's, only less finished, says, "The excrements of all kinds of animals are made offensive to them by an obviously wise protection. In building cattle sheds, therefore, I would earnestly impress upon the attention above all things to have regard to perfect sweetness and cleanliness." Again, Mr. Wilkins says, "I lately inspected one of these sheep sheds" (an open boarded or sparred floored one). "Although the weather was fine the wool of the poor animals was wet and dirty from the urine and dung sticking on the boards on which they lay, and when I entered the dirty slippery place, a smell from the gases, by the active fermentation of the dung and urine in the pit below arose offensively, and made me quickly seek an exit."

It is somewhat surprising that Mr. Mechi, whose remarks on the advantages of supplying cattle with pure and clean water are so judicious, does not see that if it is a bad thing to adulterate water which cattle drink occasionally, with the manure which is suffered by careless farmers to drain into it, it must evidently be as bad, if not worse, to allow that air which they breathe every moment of their lives to be contaminated by gases equally the products of the same manure, and which must inevitably pass into the lungs of the unlucky animals. In differing thus from Mr. Mechi, I am aware of the weight due to his opinion, and must be understood here only to state my own personal views on the subject; any one who sees the plan can judge for himself. It has, no doubt, advantages, where straw is of great value and litter scarce.

CHAPTER V.

BUILDING MATERIALS.

The stone used in the construction of farm steadings, need not be of the costly character required for the generality of large houses. Quoins excepted, the walls of all buildings may be constructed of rubble masonry; that is, masonry

reduced to something of a square shape, or irregular course, but not fixed to any positive rule, or to thickness. A most excellent description of this kind of rubble building is used in Yorkshire and the Midland counties, called snicked rubble, which is a square masonry composed of all sizes, without reference to any horizontal line in the wall course. Where stone can be obtained at a cheap rate, like the ragged flint, then the only rule to be observed is to break a face in the flint or rag stone, and lay all the pieces in the most advantageous position to form as solid a wall as possible, and keeping the face as true as the nature of the material will admit of, filling all the interstices with mortar made from hydraulic lime, and the sand to be used therein to be of a mixed quality, containing large and small grains, sharp and clean. Such walls carefully constructed, are amongst the most durable of all buildings hitherto erected.

I have myself constructed some agricultural buildings with large unfaced flints, and when the lime is good it is most excellent work. The irregular shape of the flint makes capital bond; and I found a short time after, in cutting through these walls to put up some machinery, that the flint could not be removed, but had to be faced to make fair work.

I believe that most excellent walls for agricultural purposes may be made with small irregular-shaped stones, whenever they can be got, if the lime is good. The quoins must be of brick. The cost of the work I found to be about 7*l.* per rod; the brickwork, at the same time, costing 12*l.*

In selecting stone for farm buildings, durability in resisting weather is of more consequence than size; and to ensure this, it is very important that a stone be selected of great purity in the grit, and freedom from aluminous combination, for it must be observed, that stone decomposes from two causes: first, from the material which combines the particles of grit being of a soluble character, though in an imperceptible degree; and, secondly, from the particles of grit being cemented

by alumina combined with lime, which combination is certain to decompose in a very short time, and is the cause why many good-looking stones burst after a short exposure to the weather immediately after their extraction. Such hard limestones as are combined with alumina are very liable to fall to pieces on exposure to the weather, and are altogether very deceptive as to their quality ; sometimes even capable of taking a polish, and yet dropping to pieces after exposure to the weather of only one season.

If rough flag-stones can be obtained at a cheap rate, it is an excellent method of proceeding to lay a foundation of them before the rubble walling is commenced, and also at intervals to use them as thorough or bond courses.

Bricks.—Perhaps in no description of buildings are hard, durable bricks more required than in those devoted to agricultural uses ; and in no description is the quality of bricks less attended to. If the brick be hard, and if cement be used, then many walls may be constructed in a most durable manner by joining the bricks with the cement : it has been too much the custom, however, to look at the shape of the brick in preference to the quality of hardness ; but the rule ought to be to look to the perfect vitrification of the brick throughout as the first requisite to quality, and then look to shape as the second condition ; but if all things are properly attended to in the manufacture of these articles, there is now no reason why both these qualities should not be united in the same brick, since the excise duties on bricks have been repealed, and freedom of action is allowed as to their size. Before commencing the building of a steading, an investigation of the soil of the farm in question should take place, and the facts be ascertained as to the quality of the soil for making on the spot ; and even if it be no cheaper to make the bricks on the farm, still if a careful brickmaker is selected, the quality of the article will make full compensation for all the trouble

bestowed on the manufacture: besides, coping bricks, large drain tiles, hollow bricks, paving tiles, slabs for various purposes, beveled bricks for drains, and circular tanks, can all be made at the same time, by using a little extra care in selecting and testing the clay, and using a due degree of patience in ascertaining how much of different varieties of clay (often found in the same pit) will make the best mixture.

Burned Ballast.—An article called burned ballast, has now come into very general use for making the foundation of roads. This material may be employed with great advantage in the construction of farmeries, for laying dry the roads and yards, and for filling in foundations to buildings, if mixed with hydraulic lime. If clay is in the vicinity of the building intended to be erected, and coals are cheap, then a brick-maker will easily produce the necessary supply by merely casting the clay in heaps, and mixing the clay with a due quantity of coals. The manner of proceeding being to make a small heap of coal, and surrounding it with clay; after the coal is ignited, then strew over a small quantity of coal, and when that is ignited a further quantity of clay; and so on until the heap is somewhat large: then proceed by using barrows and planks to put the clay and coal upon the top of the heap, and when it is ignited, then rake it down to the foot of the heap and cover it again with more clay—the great point to observe being that of always maintaining a perfect combustion in the mass, and, at the same time, enclosing the fire within in all its intensity: and to ensure this, it will be needful from time to time to insert rods into the interior to let in the air. Simple as the operation may seem to burn ballast, it will require incessant attention, otherwise it will be under-burned.

Many think when a heap of clay is burned through and looks loose and bricky, it is sufficiently done; but this is a mistake, the ballast requires to be as hard as the best burned

bricks, in which case it will be very much concreted into blocks—these may be easily broken into the requisite sizes. When coals are not very dear, ballast may be burned for two shillings per cubic yard; the hard blocks will answer for underground work in foundations, as well as bricks.

Timber.—Although farms often produce more timber than is beneficial for the farmer's interest, yet with few exceptions it will be better to obtain Baltic timber than use that found on the farm. If cills, foundation plates, steps, and some few other parts of buildings, be made of oak, all the rest may be constructed from such fir timber as is well filled with its own natural gum resin.

In a former part of this work, we have insisted on the advantage of saving the interest of the capital, by constructing buildings of less cost, although they may require more frequent renewals. This maxim cannot be carried out better than by constructing buildings for farmeries of timber; and to do this in the most effectual and durable manner, it will be desirable to construct all foundations (where manure is liable to be lain, or as high as drips and damp may affect the structure) of solid brick, upon which the timber framing is to be built.

The old fashioned weather-boards which overlap each other are the best of all forms for durability. Some other shapes have been adopted to look more like stone, but the wet is liable to get into the joints and cause an early decay; there are abundant examples of the old weather boarding lasting from sixty to a hundred years, having been periodically painted. When it is stated that timber buildings will be cheaper than any other description of building, exception must be made to some inland districts where bricks are very cheap and sea-borne timber is scarce; in such cases it may be as economical to build with bricks as timber, but such cases are rare—and

such places as where stone is extracted, on the farm at but little cost; it will, nevertheless, often now be cheaper to build with brick than use such stone.

Lime and Cement.—But little care is ever exercised in selecting the proper materials for making lime, nearness and convenience generally deciding the question as to the description of the lime to be used: from its being one of the materials required for ameliorating the condition of the land, it might be thought that a greater knowledge would exist as to the good and bad lime, but information brought into requisition on this head has been of a very limited kind; however, the following short rules will be found useful in judging the sort of lime which should be admitted into the work. Lime which slacks with great rapidity, and immediately falls into fine flour and sets quickly, is not good for building purposes, and but seldom for agricultural purposes; in the latter case, for its caustic quality in destroying moss and vegetable matter; yet this is the sort of lime used in most cases for constructing farm buildings. The rule to be observed in choosing limestone is this:—burn some of it, and then quench it with water, and if it slacks very slowly so as only to be just perceptibly burnt or break after half-an-hour has elapsed, then it may be considered a good hydraulic lime (that is, will set under water); such lime ought to be burned for so long a time that it will have a yellow or drab tinge when drawn from the kiln; if, on the other hand, it looks white and speckled, it is under-burnt, and will not make good mortar. Some good limes will not slack unless by exposure to the air, and only fall down after exposure for several weeks; such lime is called wind-slacked, and is the best of all limes for mortar making; if this description be well burned and then put where there is plenty of access to the air, and be turned over often so as to expose new surfaces to the weather, it will form the best mortar known;

such limes are generally extracted from the Lias formation, but other formations will offer the materials if due diligence be used in selecting them.

Cement.—Cement is a most useful material to be used in farm buildings, notwithstanding it has scarcely been introduced for that purpose; it will be found to be most advantageous to use this material in small buildings, instead of lime mortar, and thin the walls so much as will make them cost no more than an ordinary mortar wall, but great care is required in obtaining a *good strong* cement, quite fresh, and allowing the workmen to use only a small quantity at a time; if this requisite rule be not rigidly observed the cement will be inferior to mortar. Cheap cement is often not worth having, but if good and proper precautions be used, the joints so formed will be as strong as the bricks themselves. If hydraulic lime or cement be used the quantity of sand must be diminished in proportion to its cementitious power, for the stronger the adhesive properties of either mortar or cement become, the less sand they can carry. In joining bricks neat cement is the best, and if care be exercised, it is as cheap as cement and sand combined; in no case more than one of sand and one of cement ought to be used, and the lime should be so strong and binding that it ought not to require more than one and a half of sand to one of lime; although the lime generally used will carry as much as three of sand to one of lime.

Thatched Roofs.—Formerly two-thirds of the roofs of agricultural buildings in England were covered with a thatch of some description, and at the present time it is a favourite roof, and deservedly so, for it possesses some great advantages over other roofs, the principal one of which is that of maintaining an equal temperature throughout the year—the inclement cold of winter, and the excessive heat of summer, being both excluded in a greater degree by this material than by any

other in common use. Also that it can be renewed and repaired by the ordinary labourers of the farm, and that the materials are generally at hand.

The chief disadvantages are a little extra insurance (which however is amply compensated by the extra comfort it gives to the stock), and that it is a harbour for vermin.

There are various materials used in thatching ; the most common in England being the straw of wheat and rye, the latter being the best. Fern is sometimes used, and is said to last well. Ling and heath are also made use of in places where they abound ; and sometimes heath is used for the underlay, and rye straw for the top. Hoop chips for a thatch may also occasionally be met with ; but the best, and most economical in the end, is a thatch of marsh reeds, so very common in Holland and those counties of England whose physical features resemble it, as parts of Norfolk and the adjacent counties.

As the process of thatching is pretty much the same in all materials, with regard to its principles, we shall confine ourselves here to describing the methods pursued in thatching with reeds, and those who would wish to know more on the subject would do well to consult the prize essays of the Highland Society, by Campbell and Collier, on thatching with fern and heath.

The reeds used in thatching are of two kinds ; the common marsh reed (*arundo phragmites*), and the sea reed, or marrum grass (formerly known as *arundo arenaria*, but termed by modern botanists *ammophila arundinacea*). As the latter is not in such common use as the other, and is better known by its properties in binding together by its roots the loose soil on a sandy sea-board, whence it is sometimes called mat grass, we shall confine our remarks to the marsh reed, which grows wild in most marshy places in Great Britain, to a height of from five to six feet, and is in flower about July, August, or September. The outer coating of all plants of the reed tribe contains a very large proportion of silex, and their internal

fibres are arranged similarly to cords laid closely together, and for these reasons they are nearly indestructible by the weather, and of course the larger the reed, the thicker is its outer coat of silex, and the more durable it is. We therefore easily discern the cause of the superiority of reed to thick straw, and of that again to thin, and why they are both probably inferior to bamboo.

The cutting of the reed requires considerable care and attention. It is done in the winter, and is carried on until the spring starts the young plants. They are cut with a peculiar form of sickle, more bent than the usual one, and it is a great point to cut them below the water right down to the roots, as the reed is much superior in strength and durability below the water, and not nearly so brittle as above. A large number of boats are always seen employed in this operation during the season of cutting; they are then conveyed ashore and made into bundles or sheaves, and set to dry, and afterwards made into stacks.

A considerable number are grown on the Essex shore of the Thames. These, however, are not used for thatch, but by the builders of barges and other vessels in coating the timbers and planking with pitch and tar.

In Holland, an immense quantity of the reed is grown for thatching; it is much liked there, and the work is executed with great skill and care. All persons who have travelled much in Holland, must have observed the peculiarly neat and effective manner in which the large windmills, which are so thickly studded over that remarkable country, are covered with a thatch of this material; not only the head is covered, the weather boarding of the mill, from the stage upwards, is protected in the same manner. Farm-houses, barns, and agricultural buildings of all kinds, may be seen covered in the same manner, and it is considered that the thatch, if well done, will last fifty years without repair; and, if repaired at the end of that term, will last fifty more: and reed-thatched roofs are to

be found in Holland in a good state of preservation more than two centuries old.

In thatching with reed, the workman begins at the lower corner of the roof on his right hand, for instance, and keeps an irregular diagonal line or face until he reach the upper corner to his left, a narrow eavesboard being nailed across the feet of the spars, and some fleaking (which is a little of the longest and stoutest of the reed scattered irregularly across the naked spars) scattered on; the thatcher begins to "set his eaves" by laying a coat of reed eight or nine inches thick, with the heads resting upon the flanking, and the butts upon the eavesboard. He then lays on his sway (a rod rather thicker than a large withy), about six or eight inches from the lower points of the reeds, whilst his assistant on the inside runs a needle threaded with rope-yarn close to the spar; and in this case close to the upper edge of the eavesboard. The thatcher draws it through on one side of the sway, and enters it again on the contrary side, both of the sway end and the spar; the assistant draws it through, unthreads it, and with the two ends of the yarn makes a knot round the spar; thereby drawing the sway, and consequently the reed, right down to the roof; while the thatcher above, beating the sway, and pressing it down, assists in making the work the firmer. The assistant having made good the knot below, he proceeds with another length of thread to the next spar, and so on till the sway be bound down the whole length, namely, eight or ten feet. This being done, another stratum of reed is laid upon the first, so as to make the entire coat eighteen or twenty inches thick at the butts; and another sway laid along and bound down about twelve inches above the first. The eaves are adjusted and formed not square with the spars, but nearly horizontal; nor are they formed by cutting, but by driving them with a "legget," a tool made of a board eight or ten inches square, with a handle two feet long fixed upon the back of it obliquely, in the manner of the tool used by gardeners in

beating turf. The face of the legget is set with large-headed nails, to render it tough and make it lay hold of the butts of the reeds. Then another layer of reeds is laid on, and bound down by another sway, somewhat shorter than the last, and placed eighteen or twenty inches above it, and above this another and another, continuing to shorten the sways until they be brought off to nothing, and a triangular corner of thatching formed. After this, the sways are used their whole length, whatever it happens to be, until the workman arrives at the finishing corner. By proceeding in this irregular manner, seams between the courses are prevented, and unnecessary shifting of ladders avoided.

The face of the roof is formed and adjusted like the eaves, by driving the reed with the legget ; which operation, if performed by a good workman, not only gives the roof a beautiful polished surface, but at the same time fastens the reed, which being thickest towards the butts, becomes like a tapering pin, the tighter the farther it is driven.

Finishing the ridge of the roof.—In the case of reed running from four to six or eight feet long, the heads meet at the ridge of the roof, whilst the butts are still at a distance from each other. For this reason, as well as for that of the wear being less towards the ridge, the shortest (which is generally the worst) need be saved for the upper part of the roof. But even supposing the uppermost courses to be only four feet long, and that the heads (belonging to the two sides) be interwoven in some degree with each other, the butts will still remain six or seven feet asunder, and the ridge of the roof consequently be less, in a great measure, exposed to the weather. In order to remedy this inconvenience, and to give a finish to the ridges, a cap (provincially a roof) of straw is set on. Roofs thus constructed are durable, good, and cheap, and therefore much to be recommended.

Hollow Bricks.—The introduction of hollow bricks has of

late attracted considerable attention, and deservedly so, for there are a variety of situations and circumstances where they can be used with great advantage.

For cottage building, they are decidedly superior to any other material, as shown in the example cottages erected by his Royal Highness Prince Albert, in Hyde Park.

The buildings were erected with Roberts's patent hollow bricks, which are decidedly the best.

The greatest advantages derivable from the use of hollow bricks, are dryness and warmth, as well as economy of construction—considerations which recommend them, as a preventative of the evils so constantly experienced from dampness admitted through external walls. For agricultural buildings, and for inclosure, park, or fence walls, they are particularly adapted, as well as for the ordinary dwellings of the labouring classes, for schools and for houses generally of moderate height, and with the usual weight of roofs and floors, rendering internal battening unnecessary. Their strength may be adapted to circumstances, and where necessary, be rendered equal to that of solid bricks. When used for partitions, or for roof and floor arches, they are fire-proof, deaden sound more effectually, and are considerably lighter than solid brickwork. As a lining to stone or flint walls, they supersede the necessity for battening, and the consequent risk of fire and dry-rot is avoided. For cottage floors they are also well adapted.

The various forms of hollow bricks proposed prior to that which has been patented, are all, particularly in reference to external walls, more or less liable to the objection that they either will not properly bond together, and form a substantial wall, or else that the headers and the vertical joints afford a medium for the transmission of damp from the exterior to the interior.

By the form adopted in the patent hollow brickwork, a perfect bond running longitudinally through the centre of the

wall is secured ; all headers and vertical joints passing through it are avoided ; internal as well as external strength is obtained ; and every facility given for the fixing of floor plates and other timbers : whilst, by the parallel longitudinal cavities, ample security for dryness is afforded, and great facility presented for ventilation, as well as for the conveyance of artificial heat, and for the transmission of pipes, &c.

According to the specification enrolled June 15, 1850, this patent includes bricks and tiles, hollow or otherwise, of such form as will secure a longitudinal bond, whether obtained by the overlapping of the alternate or the parallel course of bricks, either with a square, a rebated, or a champered joint, and with a level, a sunk, or a bevelled bed.

The dimensions of the bricks being unlimited, a size has been chosen, which, with the omission of the headers, reduces by about one-third the number of joints, and greatly improves the appearance of the work, giving it more boldness of effect and resemblance to stone, than that of ordinary brickwork, twelve inches in length, including the joints, three courses rise one foot in height—a size equally convenient for the workmen in the manufacture, and in the use of the bricks of a larger size, their form admits of ready handling and stowage for transport.

Nine patent hollow bricks of the size before described, will do as much walling as sixteen ordinary bricks, whilst the weight of the former but little exceeds that of the latter, an important consideration in reference to carriage, as well as the labour in using.

When passing through the machine, or in the process of drying, any number may be readily splayed at the end for gables, or marked for closures, and broken off as required for use ; or they may be perforated for the purpose of ventilation. If nicked with a sharp-pointed hammer, they will break off at any desired line, and the angles may be taken off with a trowel as readily as those of a common brick.

A sufficient proportion of good facing bricks may be selected from an ordinary burning; and in laying them, a much better bond will be obtained than is usually given in common brickwork.

The bricks for the quoins and jambs may be made either solid or perforated, and with perpendicular holes, either circular, square, or octagonal: those in the quoins may be so arranged as to serve for ventilating shafts. Stone will be found equally applicable for the quoins and jambs, and the appearance of the work be thereby improved.

Hollow bricks may be made with any good tile machine, in the same manner as ordinary draining pipes, and about the same cost in proportion to the quantity of clay contained in them. They are more compressed, require less drying, and with much less fuel are better burned than ordinary bricks, even when waste heat, or that in the upper part of the kiln, only is used.

The saving in brickwork effected by the use of the patent bricks, when made at a fair price, will be from 25 to 30 per cent. on their cost, with a reduction of 25 per cent. on the quantity of mortar, and a similar saving on the labour, when done by accustomed workmen. The process of drying is much more rapid than in common brickwork; and the smoothness of the internal walls built with the patent bonded bricks, renders plastering, in many instances, quite unnecessary; whereby a further saving is effected, not only in the first cost, but also in the subsequent maintenance. If glazed on the outer face—as may be done with many clays—a superior finished surface is obtainable without plaster.

Mr. Clayton, of the Atlas Works, Upper Park-place, Dorset-square, is authorized to supply dies for making, under licence, the patent bonded hollow bricks, by his own patent hollow brick and tile machine, to which the prize of the Royal Agricultural Society was awarded at the Exeter meeting for 1850.

The following statement of Mr. Roberts, shows the comparative cost of bricks in a rod of reduced brickwork built with ordinary bricks of the common size, and a rod built with patent bonded hollow bricks :—

4300 ordinary bricks—

£	s.	d.	£	s.	d.	£	s.	d.			
at 20s.	4	6	0	at 24s.	5	3	3	at 28s.	6	0	5

2450 patent bonded H bricks—

at 25s.	3	1	3	at 30s.	3	13	6	at 35s.	4	5	9
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Saving in bricks per rod—

1	4	9	1	9	9	1	14	8
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Being 29 per cent. in favour of using the patent bonded hollow bricks, in addition to a considerable diminution in the cost of cartage or transport, and of 25 per cent. on the mortar and the labour.



Form of hollow bricks No. 1.—For the external bricks, which, with the angle and reveal bricks, are sufficient for building 9-inch walls.



No. 2.—For the internal bricks, required to form any thickness of wall beyond 9 inches.



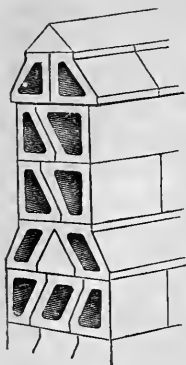
No. 3.—For angle bricks, $10\frac{1}{4}$ -inches long, with one splayed corner, which answer for the quoins for $4\frac{1}{4}$ -inch reveals, and for jambs.



No. 4.—For reveal, jamb, and chimney bricks, 9 inches long, $4\frac{1}{4}$ inches wide.



No. 5.—For 4-inch wall bricks to bond with the splayed bricks, which will also answer for floor and roof arches, not exceeding 7 feet span.



No. 6.—For chamfered or saddle-back coping, to suit a 9-inch wall, with man-drills and horses.

CHAPTER VI.

Of the different tradesmen or workmen employed—

The Excavator is the first person employed, as his operations are confined to the excavating for the foundations of walls, &c., and the preparing the surface of the ground to the necessary levels, for the yards, roads, &c. ; he is usually paid by the yard cube for excavating, and by the yard superficial for trimming, soiling, and otherwise forming the surface.

It is important, in taking out the earth for foundations, to see that all accidental soft wet spots through which the line of the plan may pass, be properly removed, and that the level be made up with concrete, large stones, or old bats. A good foundation upon which the building is to stand is positively necessary, yet it is the most often neglected, and very lately an instance came under my notice, of an expensive building having nearly all to be pulled down in consequence of the foundation at one angle having sunk ; caused, it was discovered, by this part of the building occupying the site of a pond, and which had not been observed when the foundation was got out.

The Bricklayer follows the excavator, and prepares the foundation of the building by laying in a thickness of concrete or some other hard material, upon which he commences the construction of the buildings. The principal point that he has to attend to, is, first the keeping up a proper bond, by having a sufficient number of through-headers. It is a common practice with country bricklayers, when using up old bats with the new bricks to put in two bats instead of one header ; both sides of the wall will appear, when finished, as though they were properly constructed, although the work would be in a most unsound state. The system of laying the bricks is either English bond or Flemish bond. In the first, the courses are laid alternately with headers and stretchers ; and in the latter, the stretchers alternately with headers in the same course, with a piece of brick, called a closer, near the ends of each course, in order to break the upright joints. Of the two plans, the English is by far the stronger. Great care should be taken that the whole of the brickwork, whatever form the structure, should be self-supporting, not in any place resting upon timber that may be worked into it. All openings, of whatever kind, should have relieving arches turned over them, the lintels should only support the filling in between the soffits of the arch and itself, and be merely for the convenience of receiving the fittings for the doors and windows.

The courses should be laid true and level, and the wall built perfectly upright, as uneven work weathers worse than when perfectly done. Hoop iron, where necessary, should be worked into the wall, it being better than bond-timber, and not more expensive.

A bricklayer will lay in one day when well served by his labourer, about 1000 bricks.

Brickwork is measured and valued by the rod, or the cube yard ; the latter is used in large works, such as railways, and the former is employed in all ordinary buildings, such as we have to do with.

A rod of brickwork measures $16\frac{1}{2}$ feet square, $1\frac{1}{2}$ brick thick, and is called the reduced, or standard rod ; it also contains 306 cubic feet, or $11\frac{1}{2}$ cubic rods.

A rod of brickwork, laid 11 courses to the foot, will require 4350 stock bricks ; if laid dry, 5370.

A rod of brickwork, laid 4 courses to gauge 12 inches, contains 235 cubic feet of bricks, and 71 cubic feet of mortar, and weighs 15 tons.

A rod of brickwork requires 18 bushels stone lime, and $3\frac{1}{2}$ loads of sand ; or 27 bushels of chalk lime and 3 loads of sand ; or 36 bushels of cement, and 36 bushels of sand.

A hundred pecks, or 22 stricked bushels of lime, is called a hundred.

18 heaped bushels, or 22 stricked bushels, of lime is equal to 1 yard cube ; the same of sand is 1 yard cube.

36 stock-bricks laid flat, or 52 on edge, will pave 1 yard superficial.

36 paving-bricks laid flat, or 82 on edge, will pave 1 yard superficial.

9 12-inch tiles, or 13 10-inch, will pave 1 yard.

9 12-inch tiles, or 13 10-inch holes, will pave 1 yard.

140 Dutch clinkers, on edge, or 125 laid flat, will pave 1 yard.

PAN TILINGS.

180 pantiles, laid to a 10-inch gauge, will cover 1 square superficial yard.

160 ditto, ditto, to an 11-inch gauge, will cover 1 square superficial.

150 ditto, ditto, at 12 inches, 1 square superficial.

1 bundle of laths, and $1\frac{1}{4}$ cwt. of nails, required to 1 square.

1 square of pantiling will weigh about $7\frac{1}{2}$ cwt.

PLAIN TILING.

760 plain tiles laid to a 6-inch gauge, will cover 1 square.

660 ditto, ditto, to a 7-inch gauge, will cover 1 square.

576 ditto, ditto, to an 8-inch gauge, will cover 1 square.

1 bundle laths and nails, 1 peck tile-pins, and 3 hods of mortar, to a square of plain tiling.

1 square of plain tiling weighs about $14\frac{1}{2}$ cwt.

A hod contains 20 bricks.

The Mason.—The business of the mason is to construct the various walls and other works in stone. The manner of performing this differs according to the peculiar materials he has to use, but there are certain technical terms applied to the different manners of laying the stone which forms the work, that are common to all descriptions of stone. The first is called Ashlar work ; in this the stone is all dressed and squared, and the whole work finished in the best manner. This is, of course, the most expensive mode of constructing with stone, and cannot, in any way be suitable for erecting agricultural buildings, as equal strength and beauty may be attained by other and cheaper methods.

The second manner is called Coursed work, in which the stones are assorted into sizes, and laid in regular courses, having been previously squared.

The third manner is called Rubble work, and is the one best adapted to the purpose in hand ; in this the stones are used without being squared.

The quoins should be long and short alternately ; the long ones allowed to run their full length into the wall. There should be no stone set up on end to form jambs, but several stones, lying on their bed, should form this, if strong work is required as they have the advantage of better bond.

Mason's work is charged for by the cubical content, as it arrives at the banker or stool at which he works. The labour is charged by the superficial foot, according to its character,

whether sunk, moulded, or plain. Rubble work is charged for by the rod, as in brickwork.

Pavings, landings, and all stone less than 3 inches thick, are charged by the superficial foot; copings, curbs, &c. are charged by the foot run, dowels and mortice-holes separately. If heavy stones are to be lifted any height, hoisting is charged extra. It is important, in the erection of farm-buildings, (cheapness being always kept in view,) to use the local materials, if possible; and where this is done, I would recommend that local masons be employed in preference to strangers, as the durability of stone generally will depend upon its being laid on its true bed, and in a manner known only in the locality. On many railway works I observe the stone is crumbling to pieces from neglect of these precautions, whereas, had the stone been set by those who knew its local peculiarities and with proper care, and if previously well weathered, these same works would have stood without decay for ages.

Carpenter.—The business of the carpenter consists in constructing all the various floors, roofs, and partitions. The carpentry of a steading is a very important part, as upon the judicious management of the various beams, posts, ties, struts, &c., the strength of the work will depend, as well as economy of labour and materials. Carpenters, such as are usually found answering to that name, in the rural districts, are a most incompetent set, and seldom can be entrusted with the smallest thing without superintendence. They cut the stuff to waste in every direction, and use scantling of unnecessary size, and afterwards render this too weak, by cutting out a great mortise-hole for a large tenon, where none may be required. The whole of the carpentry of the steading should be designed by the architect, and superintended by some person; the dimensions of the scantling being reduced to a minimum, will not allow of being weakened by these bunglers.

The business of the joiner, in contradistinction to that of

the carpenter is, that the former uses a plane, which the latter does not use. The work of the joiner about a farmery is of so plain a character, that it may be done by the carpenter, unless it be the interior fittings of farm-houses, in which case I would recommend that joiners be employed who really understand their business, the country joiners often resembling those in the backwoods of America, the distinction between whom and a carpenter is stated to be, that the carpenter is an axe and a saw with a dollar a day, and a joiner is an axe and a saw with two dollars a day.

The labour of the carpenter is valued at per square (one hundred feet) superficial, and the labour of the joiner, at per foot superficial, according to the description of work. Mouldings and thin stuff wrought at per foot run.

The Plumber.—This tradesman requires superintendence as much as any one; his business chiefly consists in laying down sheet-lead for a variety of purposes; such as gutters, flats, flashings, linings, &c., &c. The lead is made in two ways: the one is called milled or rolled lead, and the other cast-lead; it is supplied at per cwt., of the various thicknesses specified, as 4lb. 5lb. 6lb. or 7lb. to the foot superficial. It is heavy and expensive, and therefore offers great temptation to dishonest persons to impose upon their employers; and, I am sorry to say, I know instances of apparently highly respectable persons contracting to lay down lead of a certain weight, and laying down something much lighter. This is not a common case: it is to be hoped that few builders would be found taking such dishonest advantages, but it is a very common case to find the light lead laid down, for the reason that the contractor sublets the plumber's work to some small man, perhaps, and neglects to look after it himself, considering that if the architect is satisfied, he ought to be; and a great injustice is done the proprietor of the buildings, by the neglect of one and the rascality of the other.

Cast-lead is manufactured sheets of lead, cast from old lead by the plumber at his own shop, (and not milled). This lead

ought not to be used for any purpose of the least consequence, as it is sure to be air-blown, and has small holes in it, through which the water is sure to find its way. Lead should never be laid for the water to stand upon it, on roofs or other places, but always have proper current found for it to run off.

Flashings should be all turned up into the joints of the brickwork, and secured with wall-hooks not more than 18 inches apart, and the joint made good with cement. All lead services and waste-pipes are jointed and laid by the plumber; and care should be taken to see he uses a sufficient quantity of solder.

Plumber's work is paid by the cwt., and lead pipes are measured and charged by the foot run, according to its size; and the joints are counted, and charged also according to the size of the pipe so jointed, and no allowance for solder is made.

Weights of Lead Pipe per Yard.

	lb.	oz.			lb.	oz.
$\frac{3}{8}$ inch . . .	3	3		$1\frac{1}{2}$ inch . . .	11	0
$\frac{1}{2}$ " . . .	5	7		$1\frac{3}{4}$ " . . .	14	0
1 " . . .	8	0		2 " . . .	21	0

Zinc.—This is a cheap metal, and very light, and if it can be managed satisfactorily, a great saving is effected. It is usual, in country towns, to combine the working of it with that of the plumber. It is, however, a very brittle article, and not adapted for flats or gutters, as it is easily affected by the weather, and liable to buckle up and crack.

Glazier.—This business is generally carried on by the same person as the worker in lead. It is valued by the foot superficial, and the price is varied according to the sizes of the squares, but such kinds as will be wanted in the construction of a farm cottage would be at once stated. It is measured between frame and frame, and the sash-bars are included in the quantity.

Crown-glass is sold by the crate, the price varying with the quality. There are three qualities, and a crate of 1st quality contains 12 tables; 2nd, 15; 3rd, 18.

The Smith.—As a smith's shop is a necessary part of an ordinary large homestead, it is well to construct it at once for the convenience of making all irregular iron work that may be required; but everything that is an ordinary article of commerce, such as screws, nuts, bolts, hinges, locks, latches, &c., &c., should be purchased of the ironmonger, as they are well made in the district from whence they come, at a quarter the price they could be got for elsewhere. Formerly, most of the iron-work required was wrought, now cast-iron is used for the same purpose, and answers equally well at a much less price, such as gratings, stable-fittings, gutterings, rain-water pipes.

The Sawyer.—In constructing a farmery, the less you have to do with the sawyer the better, as he is a most expensive assistant, and sawing will be found to form a large item in the cost of the work. It is advisable, therefore, to have the scantlings well arranged, as large a quantity as possible of the same dimensions, and as much repetition of the same parts as possible; if this be done, and the place be built of foreign timber (which, for reasons before stated, it is advisable to do), it may all be cut at the sea-port or other market where it is purchased, and when the sawing is done by machinery a great saving may be effected. In this way, if the timber off the estate be used, and the farmery of any extent, it will be worth while to fit up a circular saw-bench, to be driven by the motive power that is intended for the steading, which should be the first thing fitted up.

The Millwright is the most expensive tradesman required in the completion of the steading. The millwright will be required to fit up the various machines, and the motive power; to lay the shafting, and construct the necessary hoppers, shoots, spout, &c., for the efficient working of this department. In all cases this should be done by contract with some respectable house in the locality. In every locality there are persons both of capital and skill, who will undertake the completion of this portion entirely.

It is always wise to go to first-rate concerns, (such as Ransomes & May, of Ipswich; Garrett & Son, Suffolk; Barrett, Exall & Co., Reading; Hornsby, Stamford; Tuxford, Boston, &c.; and for this reason, that it is only houses of large business who have, or could afford to have, machine tools of such description as are necessary for executing millwrights' work, with mathematical accuracy, as it ought to be, and with the strictest economy, so necessary for the purpose of the agriculturist. The use of machine-tools has cheapened and improved machinery immensely, and it is impossible that little village concerns, where everything has to be made by hand, can successfully compete with large manufactories; they will often undertake to do things at as low a price, it is true, but then, "how do they do it?" Why, there is so much to be done afterwards, in alterations and re-adjustments, that they will far exceed the large houses in price for a worse article.

I do not think the same rule holds in reference to all the implements of the farm. Ploughs, for instance, may be made by a small concern quite equal, or, I will admit, better than a large one; for it generally happens that the principal, in this case, is a man of more than ordinary intelligence, and has given his attention almost exclusively to this one implement. There are several second-rate concerns that have a great reputation for one or two particular things.

And some of the larger firms, such as Howards of Bedford, devote themselves to a few things, and excel all others in the manufacture of them.

There is a certain class of men called millwrights, small jobbing fellows, who work occasionally at the little corn mills, and job about. Of these men the farmer should keep himself perfectly clear; they are a race fast disappearing, and the sooner they are quite gone the better; they are idle, ignorant, and dissolute, do very bad work, and charge a monstrous price for it.



